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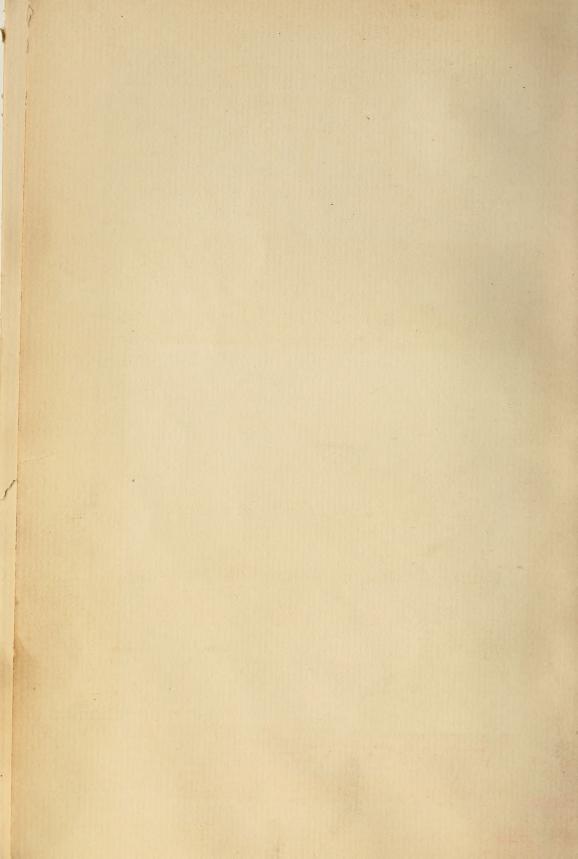
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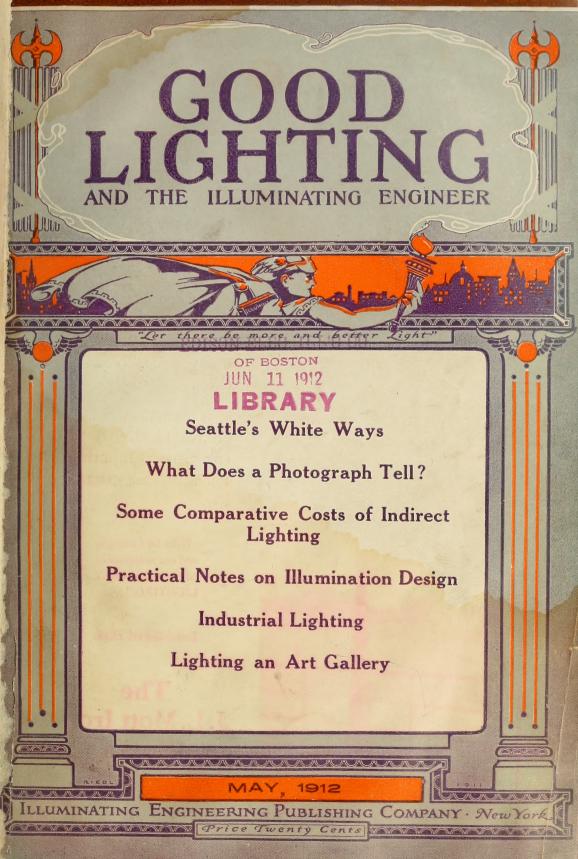
JUN 14 1913

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Fifth Ave. & 17th St.

New York



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is the color that suits me best"—sang "Gene" Field, although he admits that

* there is much to be said

For yellow and green and the rest

Still he prefers red because—

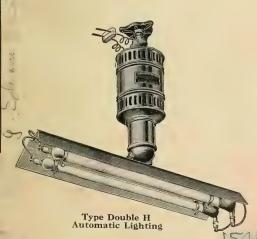
There's that in red that warmeth the blood And quickeneth a man within, And bringeth to speedy and perfect bud The germs of original sin.

"There's many a truth oft spoken in jest." Scientists tell us that red heats the sensitive nerves of the eye, and causes strain, congestion and fatigue. The "quickening" is the result of irritation; and irritation of the nerves will surely develop original sin!

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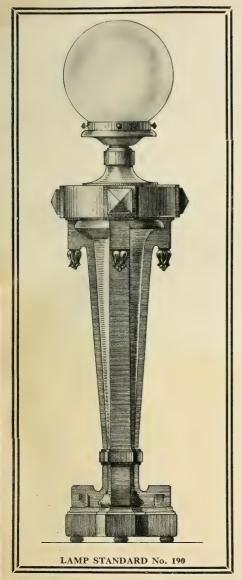
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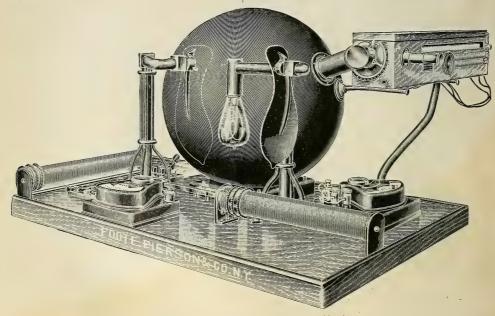
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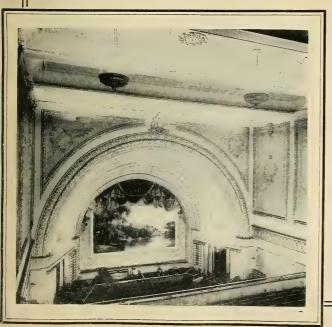
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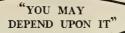
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GOOD, LIGHTING

AND THE ILLUMINATING ENGINEER

Vol. VII

MARCH, 1912

No. 1

EFFICIENCY

Engineers tell us that efficiency is the ratio of the power put into a machine to the work gotten out of it; or more briefly, of energy expended to results produced.

The value of the workman does not depend upon the number of motions he makes in a given time, but upon the effect of his motions upon the work in hand. Generally speaking, the workman who SEEMS to be doing the most and working the hardest is the least efficient; he is expending too much energy for the results secured. It is the man who makes the fewest possible motions, but each so directed as to utilize all its force that turns out the best and largest amount of product. Every extra motion means lost power and lower efficiency.

In the human machine lost motion not only means less accomplished, but as in all other machines, a greater amount of wear and tear. WEARINESS MORE OFTEN COMES FROM WASTED ENERGY THAN FROM ACCOMPLISHED WORK.

The maximum efficiency of the individual can only be secured under the proper conditions. In this respect the human machine differs radically from the physical machine, in that it is a sentient being; the mysterious action of mind and feeling has a powerful influence upon its mechanical action. The human being must have the will to do as well as the power.

The one condition having the greatest effect on the efficiency of the human machine is light. If all of the wasted energy due to poor illumination could be recovered it would go far toward reducing the high cost of living of which the world is complaining.

Poor light is a double drag on human efficiency; it interferes with the mechanical action of the body, and by its depressing action upon the mind reduces the available energy. Well lighted surroundings strengthen the will to work, as well as the ability. Without light there could be no work; with poor light but partial results can be secured; only under the best light can the laborer, whether mental or physical, produce all of which he is capable.

LET THERE BE MORE AND BETTER LIGHT.

E. L. Eleist.

A Year's Progress in Illuminating Engineering

What Has Been Accomplished for the Cause of More and Better Light During the Past Twelve Months

The most superficial glance over the pages of history shows that the progress of humanity, whether in the domain of material welfare, social relations or political institutions, has always been a fluctuating quantity. Expressed by the favorite method of the scientists, it would be represented by a succession of waves, connected by approximately straight lines. Discoveries in science, like reforms in morals and politics, are marked by epochs remarkable achievement, followed either by periods of rests or retrogression. If we may take the geologist at his word, the earth's crust, as well as the life upon it, has followed this same law of variation.

These sweeping generalities are suggested by our first glance over the progress of illuminating engineering during the past year. There has been a general halt in the remarkable discoveries and achievements that, by coincidence, immediately followed the first efforts to establish the new science and profession of illuminating engineering. The discoveries in the ways and means of producing light which have been developed since that time were revolutionized, but the revolution is now so far advanced that it has lost its sensational character, and settled down to the inevitable period of peaceful reconstruction. Not a single new element has come into the field during the past year; the forces that were with us a year ago are in full command to-day, without change either in officers or rank and file, but they have simply held their ground and extended their outposts.

THE TUNGSTEN LAMP

If we were to select the one discovery which has had the most far reaching effect in the general revolution it would undoubtedly be the tungsten electric lamp. The two problems which the commercial introduction of these lamps presented, namely, the effect upon the

revenues of the electric lighting industry, and the limits of perfection and cost of manufacture have been very nearly, if not quite, settled. The lamp is here to stay until succeeded by its superior, and electric lighting interests have adapted their policies to the new condition without financial loss or disturbance. The limit of perfection of the lamp has apparently been reached in the production of the drawn-wire filament and in methods of producing the sintered, or squirted, filament of apparently equal strength. The limits of manufacturing cost, now that the experimental stage has practically been passed, must very soon be The electric lamp seems to have reached the limit of perfection, depending entirely upon radiation from a solid, unless some radically new discoveries are made in the field of physical chemistry—an event, however, which is not impossible; there are rumors that carbon may again take its place as the leader in the field.

THE NEW ARC LAMPS

The new forms of arc lamps, the flaming arc, and the metallic or luminous arc, have not materially changed during the year. The hope that was held out of the successful production of a long burning flaming arc has not been realized, at least to the extent anticipated. The ground for hope is by no means wanting, but the problem has not yet been solved.

The magnetite or luminous arc has further demonstrated its usefulness in cases of public lighting, and has lately been brought out in an inverted form, which adds greatly to the possibilities of its artistic treatment, which will undoubtedly increase its use in that class of public lighting which is generally designated as decorative. The first installation of this form in New Haven, Conn., has attracted much favorable comment. Only one minor criticism has been offered, and

that is that a very much larger globe should be used, for the appearance of the lamp and post by daylight, as well as a better diffusion of the light by night.

The only noteworthy development in the carbon arc has been the apparently successful effort to fit it with an absorbing screen, so as to give an illumination of daylight color value. The carbon electric lamp is being steadily superseded by the tungsten lamp, a process which will be much accelerated by the greater mechanical strength which the tungsten filament now possesses and the production of lamps of smaller sizes. It seems to be inevitable that the carbon lamp, both arc and incandescent, must eventually be entirely supplanted.

GAS LIGHTING

In gas lighting the two improvements that we noted a year ago, namely, the high pressure lamp for exterior lighting, and the artificial silk mantle, have progressed no farther than experimentation on a commercial scale. The high pressure lamp has been put to test to such an extent, however, that its introduction as a tactor in public lighting seems sure to take place within the coming year. Its success in Europe will undoubtedly be repeated in this country, though to a lesser extent, owing to the radical difference in commercial conditions governing the production of gas and electricity. The inverted mantle gas lamp working at ordinary pressure has made some headway, and will doubtless make more rapid strides in the year to come.

The inverted mantle gas arc, working on ordinary pressures, has been still further improved, especially in its adaptation to outdoor conditions, and its efficiency and reliability as a street lighting unit have been fully demonstrated. There has also been some successful effort in adapting this form of lamp to the cluster lighting posts which have become so popular. The manufacturers are now seriously bidding for street lighting business with this new type of lamp, a certain portion of which must inevitably be secured. There has been a decided awakening on the part of gas companies with regard to the necessity for pushing gas illumination on modern illuminating engineering lines, with the result that gas lighting has rather more than held its own during the year.

The artificial silk mantle has had what may be called its last stage of practical experiment, that is, its use under service conditions to a considerable extent, but under the surveillance of its manufacture. Its more general commercial use may, therefore, be predicted in the immediate future.

Acetylene has maintained its steady but unostentatious progress in its particular field as rapidly and successfully as could well be expected without any spectacular developments.

A new form of luminant which attained considerable notoriety on its first announcement several years ago, but which has been lost to public view since, is about to be heard from again in a more substantial way; this is the so-called Blaugas. The fact that so little has been heard of this illuminant by the public is readily explainable; the first announcement was made on the discovery of the process; but between such a discovery and the working out of the problems of manufacture, distribution and sale there is necessarily a conceivable lapse of time.

The company owning the American rights have abundant finances, and have made satisfactory progress in working out the practical problems involved. The general introduction of this illuminant to the public is apparently at hand.

LIGHTING ACCESSORIES

In the field of lighting accessories the same general condition has prevailed as in the means of producing light; that is, there have been no distinctly new developments, but only minor improvements. There are some variations in the forms of prismatic reflectors mostly with respect to their decorative appearance, and there has been a multiplication of reflectors of the type of glass to which no generic term has yet been applied, but which first was introduced under the name of "alba" This multiplication of product is characterized by a disheartening repetition of designs. Originality in the developments of lighting glassware is conspicuous only by its absence.

In lighting fixtures the same general observations apply as a year ago. unsatisfactory condition of the business from a commercial standpoint, which we referred to then, has been sadly evidenced by several receiverships, and it seems probable that the end of this drastic method of reconstruction has not yet been reached. On the other hand there are very notable instances of an undoubted financial success in this field. have pointed out from year to year since the new high efficiency light-sources first made their appearance, the revolution in methods of illumination which their improvements were bound to bring about must carry up with it a revolution in the methods of design, manufacture and sale of lighting fixtures. In a revolution one or two things happens to the individual; he either joins the revolution and shares in its success, or he opposes it and is overthrown and exterminated. The inevitable has happened; the overthrow has begun. We again reiterate that the business of the design, manufacture and sale of lighting fixtures is bound to undergo a complete revolution; those who keep abreast of the progress of this revolution will succeed, while those who seek to evade and oppose it will fall in its path.

ILLUMINATING ENGINEERING

In the field of illuminating engineering proper, i e., the application of light, the progress during the year has been substantial and satisfactory. The most noteworthy development has probably been the increasing interest shown in the subject of illumination by those who have official oversight of conditions in the industries. This includes the factory inspection authorities of the different States in this country, and a number of civic associations. Particularly significant is the appointment of a commission by the French Government to investigate the whole subject of industrial lighting in connection with the health and efficiency of operatives. The fact to which we have repeatedly called attention, that efficiency of the user of light far outweighs any considerations of mechanical efficiency, has steadily gained recognition. The prominence which the so-called "scientific management" has achieved has naturally assisted in bringing this phase of illumination to the front.

The past year has witnessed more definite experiments and investigations in this line than perhaps all the preceding years put together.

A further evidence of the growth of practical illuminating engineering is found in the commercial literature of the various companies engaged in the manufacture and sale of lighting appliances, such literature showing a great increase in the amount of engineering data and instructions which it contains. There is plenty of evidence of a constantly increasing tendency to consider illumination as an engineering problem, and to have lighting installations laid out on engineering Illuminating engineering as a science has passed the state at which it is met with contempt or indifference, and has firmly established a position which demands respect and confidence.

PROBABLE LINES OF PROGRESS DURING THE COMING YEAR

The devotee of the turf, we are told, bases his bets on past performances, and while there are many surprises, if his study is sufficiently comprehensive and his methods of reasoning logical, the chances of his winning in the long run are favorable. Scanning the past performances in the lighting field, our best bets for the coming vear would be as follows:

In interior illumination concealed lighting, especially by the indirect and semiindirect methods, will maintain the rapid progress that it has made during the past

vear.

The use of "white" artificial light by merchants will take place to a commercial

The relation of light to human efficiency will be more generally recognized and studied in the industries.

The fixture trade will still further recegnize the necessity of conforming their product to modern methods of illumination, with the probability of still further financial failures.

In exterior illumination decorative street lighting, both with tungsten lamps and the new magnetite arc, will make special headway in the East.

The inverted mantle gas lamp, both with compressed gas and ordinary pressure, will begin to make itself felt as a factor in public lighting.

Good Reading Lights-and Bad Ones

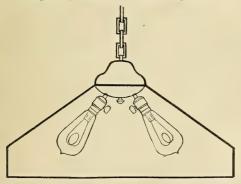
How to Save Your Eyes and Reduce Your Lighting Bills

ILLUSTRATED BY WILLIAM GROTZ

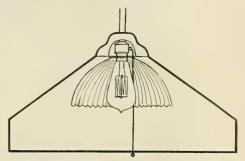
II.—PORTABLE LAMPS

In the previous article we considered the chandelier as a lighting unit and showed how its usual faults might be easily and cheaply corrected. The first method suggested was the substitution of the type of fixture known in the trade as a "dome" in place of the chandelier. The statement was made that "a dome serves the same purpose as a good table lamp, with the advantage of having no standard or base underneath." We will therefore treat of this fixture a little more in detail before passing on to the portable lamp.

The dome is recommended as a reading light for the reason that its general form is such that it may be made to fulfill all the essential requirements of a good reading light. It is quite possible, however, for this type of fixture to transgress all of these essentials, and to be as uneconomical and unsatisfactory in its results as the chandelier. In order to give the proper result the dome must be so constructed and hung that the lamp or light-source is entirely hidden from view in any position in which the eye would naturally be located, while at the same time giving light over a sufficiently wide area to enable the illumination to be used in the most advantageous manner. This requires that



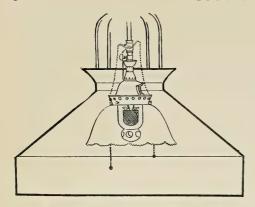
THE OLD ARRANGEMENT OF LAMPS; GIVES FOOR RESULTS AND WASTES ELECTRICITY.



THE CORRECT ARRANGEMENT, USING THE NEW MAZDA OR TUNGSTEN LAMP AND PRISMATIC REFLECTOR.

the dome should be fairly deep, and that the light-source should be placed well up in the shade. A failure to observe this latter point is very frequent. A common method of construction is a cluster of lamps projecting at an angle, as shown in Fig. 1. This arangement is faulty from every point of consideration; it brings the lamp so low down that it is in plain view from almost any position in which one would naturally sit, and it requires the use of all the lamps in the cluster to produce a uniform illumination. The ordinary 16 c.-p. "bulb" requires about 56 watts of current (the watt is the electrical unit by which the current is measured and charged for in the lighting bill, the length of time it is used being, of course, figured in. The basis of charge is the kilowatthour, which is equivalent to 1,000 watts of current used for one hour, which is equivalent to 100 watts used for ten hours, and so on). If there are three lamps in a dome, therefore, it will use about 165 watts of current with all three burning.

The proper arrangement of a dome, as stated in a previous article, is with a single lamp, so as to take advantage of the new high efficiency Mazda or tungsten lamps. These lamps are rated in size according to the watts of current which they



DOME FITTED WITH MODERN INVERTED GAS ${\sf LAMP}.$

consume. A 60-watt Mazda or tungsten lamp will give all the light required. All electric lamps give out their strongest light sidewise, and hence in order to get the light below where it is wanted for reading purposes it is necessary to use



TABLE LAMP WITH MAZDA OR TUNGSTEN LAMP

AND PRISMATIC REFLECTOR.



A TYPE OF TABLE LAMP THAT IS MORE ORNAMENTAL THAN USEFUL. THE "SHADE" SHUTS OFF THE LIGHT EXCEPT IN A SMALL CIRCLE AROUND THE LAMP, MAKING IT NECESSARY TO PLACE THE READING PAGE ON THE TABLE; RESULT, A STOOPING POSTURE, WITH DIRECT REFLECTION FROM THE PAPER INTO THE EYES.



A FABLE LAMP THAT IS BOTH ARTISTIC AND USEFUL. THE HIGH "BASE" AND BROAD, SHALLOW SHADE SPREAD OUT THE LIGHT SO THAT THE READER CAN SIT IN THE CORRECT POSITION WITH LIGHT COMING OVER LEFT SHOULDER.

some form of reflector. Reflectors of either prismatic or white glass should be used in this case, since they let enough light through to illuminate the stained glass of the dome, thus bringing out its artistic effect. A dome properly arranged is shown in Fig. 2. A single 60-watt Mazda or tungsten lamp in such a dome would give far better illumination than the dome with three ordinary bulbs, and would take only a little more than onethird as much current. The bulb should be frosted on the lower part. Glass bead fringe is sometimes used as a decorative finish for the lower edge of a dome. This is very often a nuisance in giving a streaked light and in producing unpleasant glitter of the beads.

Where gas is used equally satisfactory results can be obtained by means of a single inverted mantle burner, as shown in Fig. 3.

Table lamps should be carefully divided into two classes: those which are intended

to serve merely a decorative purpose and those that are to be used to furnish light for reading or other similar purposes. A great majority of the lamps offered for sale are designed primarily with a view to their appearance and should be considered as pieces of bric-a-brac rather than practical lamps.

In the majority of cases the shades are so small or contracted at the bottom, and the bases so low that, in order to use them for reading it is necessary to place the book on the table almost directly under them.

Right here we may stop to consider the proper position of the body when reading, which is a matter of great importance, especially with children and young people. Stooped shoulders may indicate the scholar, but they also indicate a scholar-ship which has neglected what should be the first and most vital purpose in education, viz., the production of a sound and well developed physique. A spinal col-

umn laterally curved is another not infrequent result of improper postures habitually indulged in by children during the time of study. In reading the page should be as nearly as possible in a plane at right angles to the axis of the eye. A book laid flat on the table is therefore doubly bad, because it induces a stooping posture of the body, and even then does not bring the page into the proper angular position. When, as is usually the case, the lamp or light is placed directly in front of the reader, so that it reflects its light directly into the eyes, the worst possible combination is produced. Where it is necessary to use a support of this kind, as in writing, it should be inclined at an angle of about 30 degrees. The most important case to which this applies is the desks at which school children work, since their plastic and growing bodies very readily acquire permanent "set." Adults who find it necessary to work continuously will find

that an observance of this rule will greatly reduce their fatigue.

For reading the familiar rule to have the light come over the left shoulder should be followed wherever possible. A natural inclination of the head will then allow a book to be held in an easy position at the right distance from the eye, and practically perpendicular to the optical axis. A table lamp then should have a sufficiently high standard or base, and a large enough shade so that the reader may sit with his left side to the table, with the book held in its natural position, and receive the full light upon its pages, while the eye is protected by the shade. The most efficient device for this kind is an arrangement whereby a single electric lamp is held in an upright position, with a white or prismatic glass reflector above, and an art glass or silk shade on the outside, if decorative effect is desired; otherwise the familiar green and white porce-



READING IN BED MAY BE DONE WITH SAFETY AND COMFORT TO THE EYES UNDER THE CONDITIONS SHOWN HERE. THE FIXTURE CAN BE HAD OF ANY GOOD ELECTRICAL DEALER,

AND IS NOT EXPENSIVE.



ONE OF THE MOST GENERALLY USEFUL FORMS OF THE PORTABLE LAMP. IT CAN BE PLACED ANY-WHERE, AND GIVES AN ABUNDANCE OF LIGHT JUST WHERE IT IS NEEDED, WHILE COMPLETELY SHADING THE EYES.

lain shade will answer both purposes. Where gas is used a single upright mantle burner, provided with reflector and shade, will give equally good results.

One of the most convenient arrangements for a portable lamp is with a base resting upon the floor. This allows the lamp to be placed in exactly the right position with reference to an easy chair, and forms the most ideal reading light of all. Such lamps are regularly for sale and are not unduly expensive. Such lamps are arranged for electric light, as moving the standard about would be likely to break the mantle of a gas lamp.

Some people read in bed from

choice, others on occasion from necessity. "Gene" Field confesses to a weakness in this respect in his own inimitable humorous manner:

But what of those who scold at us When we would read in bed? Or, wanting victuals, make a fuss If we buy books instead?

While the practice has been generally condemned, there is no special reason for this provided that a few simple precautions are observed. The first of these is that the body should be in the position commonly expressed as "sitting up in bed," and the second that the light should

be from the back or side. With the usual arrangement of the light in the center of the room, as a chandelier, and of the body reclining, the conditions are about as bad as could be. The portable reading lamp resting on the floor can be utilized in this case to good advantage by placing it at the side, or just back of the bed. Little reading lamps especially designed for at-

tachment to the head of the bed are also made and are most convenient of all, as the light is very near the natural position of the book.

In every case a frosted bulb should be used in a portable lamp, otherwise there will be bright and dark streaks thrown on the table, which are exceedingly annoying to the eyes.

The Illumination of Holy Trinity Church New York

A Remarkably Effective Adaptation of Modern Light-Sources to Church Architecture Based on Historic Lines

"The truth endureth forever"; and as religion is the embodiment of the results of man's search after truth, it must endure in proportion to the success of such search; and with the endurance of its spiritual truths there will inevitably follow the endurance of its material symbols. Thus it happens that the Christian church edifice of to-day is still found in its greatest perfection in substantially the form that it existed more than a thousand years ago.

While science has entirely revolutionized the domain of general knowledge, the elementary principles of architecture have in no wise been affected by this change.

The oldest form of the Christian church was that known as the basilica, the ground plan of which is in the form of a Greek cross, while the later Gothic church took the form of the Latin cross. American church architecture in recent years has shown a decided tendency to return



FIG. I .- INTERIOR OF THE MOSQUE OF SAINT SOPHIA, CONSTANTINOPLE.



FIG. 2.—INTERIOR OF THE "MOTHER CHURCH" OF CHRISTIAN SCIENCE, BOSTON.

to the older form, of which the structure under consideration is an example. The general plan and arrangement suggests the church of St. Sophia, in Constantinople, which was converted into a mosque upon the conquering of the city by the Mohammedans. Another prominent structure, perhaps still more closely resembling the original, is the "mother church" of Christian Science, in Boston, the lighting of which was reviewed in the January, 1907, issue of this magazine.

The local conditions surrounding the Holy Trinity Church, New York, were such as to render the basilica type almost a necessity, since it occupies a site in the midst of a city block between Broadway and Amsterdam avenue, and hence has no assurance of permanent natural light, except from one façade facing the street. A large central dome supported upon pillars at four equi-distant points, which is the usual construction of the basilica, permits of the use of ample skylight for all daylight illumination. While the street façade is treated with a due consideration

for architectural effect, it hardly prepares one for the surprise awaiting in the interior. Here the side walls, instead of being covered with the usual plaster and paint decoration, are faced with enamel brick of a warm, golden brown tone. The columns, capitals, and frieze are of a somewhat colder tint buff terra cotta with light green panels. Above the line of frieze the facing is of tiles to harmonize in tint with both the walls and columns. The woodwork is of dark brown oak. Contrasting with this harmony of color the sanctuary and screen stand out in white marble with Mosaic decoration.

Beautiful and appropriate as are the architectural features, it is in the scheme of artificial lighting that the greatest originality of conception and courage in execution are shown, for while there are many precedents for the former, there were none for the latter, with possibly a single exception.

Owing to the similarity of the general architectural features of this church and the Boston edifice, it will be interesting to compare their systems of illumination. We are, therefore, reproducing the illustrations used in the issue above referred to.

Fig. 1 is an interior view of St. Sophia, and shows the original lighting fixture which is still in use. It is in the form of a huge chandelier which supports a large number of tiny lamps in which olive oil furnishes the luminant.

In the Boston church, shown in Fig. 2, the same general method of illumination has been allowed, the chandelier being retained as the principal source of illumination, electric lamps being substituted for the primitive oil lamps. This building differs architecturally from the New York church in having two galleries, which offered an additional difficulty in its illumination; those sitting in the upper gallery have the electric lamps squarely in front of them.

In the New York church the chandelier has been dispensed with, and the distinctive advantages of the electric lamp

have been utilized in accordance with the most modern ideas of illuminating engineering. To furnish the requisite amount of general illumination the niches above and back of the double columns supporting the four main arches have been used as the chief sources of illumination. In each of these is concealed twelve 60-watt tungsten lamps, fitted with specially designed Frink reflectors, which throw their rays against the light mosaic lining of the niches, from which it is diffused over a large area beneath the dome. The mosaic is of such a tint as to give the reflected light a warm, mellow color, suggesting the golden tints of sunshine.

To supply additional illumination to the sanctuary 35-watt tungsten lamps are set in the panels of the frieze at each end, there being eighteen on each side. The arch of the altar is especially illuminated by lamps concealed behind a censor-like fixture suspended immediately in front. The effectiveness of the artificial lighting



FIG. 3.—A CORNER OF THE INTERIOR OF HOLY TRINITY CHURCH, NEW YORK.



FIG. 4.—SANCTUARY, HOLY TRINITY CHURCH, BY ARTIFICIAL LIGHT.



FIG. 5.—THE SANCTUARY BY DAYLIGHT.



FIG. 6.—LOOKING TOWARD THE REAR, HOLY TRINITY CHURCH.

is well shown by comparing Fig. 4, which is taken by artificial light, with Fig. 5, a daylight view.

Fig. 6 is a view looking to the rear, which shows the supplementary lighting of the gallery by standards. There are also clusters of lamps on the ceiling of the galleries, and gas brackets for emergency use. Standards above the gallery pillars are fitted with gas lamps for the same purpose. Electric lamps suitably equipped with reflectors are also distributed above the skylight of the dome, these being intended for use on special occasions.

As an engineering feat it is interesting to note that the central space, 60 ft. square, is lighted by electric lamps 30 ft. above the floor, occupying a space of less than 10 per cent. of the periphery, and consuming but 2,880 watts.

The success of this installation is of interest to a far wider extent than the mere satisfaction of the pastor and congregation of this particular church. It is a concrete and impressive demonstration of the value cf illuminating engineering. Those who come to scoff at this new science and profession may well remain to pray under this convincing proof of their error. The results as shown were not obtained by guesswork, nor by a mere chance "happy idea," but were obtained only by accurate illuminating engineering work. If one questions the advantages of treating illumination as an engineering problem let them compare the lighting of this church with that of any other similar edifice lighted by old-time hit-and-miss methods.

"White Way" Lighting in Fort Worth, Texas

An Installation that Combines a Police Signal System with Decorative Street Lighting

By Robert Montgomery

The "White Way" lighting in Fort Worth was donated to the city by the Fort Worth Power & Light Company, and was installed by the Cleveland Construction Company, Cleveland, Ohio. The standards are equipped with 100-watt 110-volt Mazda lamps in the large globe at the top and four 60-watt 110-volt Mazda lamps in the smaller globes. The standards are spaced 130 ft. apart, and a switch is located in every tenth standard which controls ten standards.

The lines are fed from two circuits. The 60-watt lamps are turned out at 11 o'clock and the 100-watt lamps burn all night. On every other corner a standard is equipped with a fire alarm, the box being fastened to the side of the post, and

the globe at the top of the standard has a red band around it, about 4 in. wide, with the words "Fire Alarm" on each side of the band in white letters. On every other corner the large globe has a green band with the words "Police Alarm" on it in white letters. A police alarm bell is also attached to the alarm box on the side of the pole. When the police station desires any special policeman to call the station they ring the alarm on his beat, which causes the bell to ring, and after night a little relay disconnects the lamp in the large globe with the green band around it. When the officer notices the lamp out he calls the station.

This "White Way" lighting extends a distance of a mile and a half through



A SECTION OF THE "WHITE WAY" BY NIGHT.

the business district on both Main and Houston streets. These standards are also arranged, on the corners of the blocks only, on several other streets surrounding the business streets, but were put there mainly for the benefit derived from the fire and police alarm.

The conduits for this work are carried along the edge of the sidewalk in trenches which were dug in the sidewalk with pneumatic air drills. A portable motor driven air compressor was hauled along the street on a truck, supplying the air for the operation of these drills, and as it only required a very small trench in the sidewalk, the work was much less difficult than would be supposed and was carried along very rapidly with a large force of men.

All of the wires in the fire district of Fort Worth are being put underground, and the transformers for feeding each block are located in the alley on a steel frame support. On account of the fact that every corner where the switch was located for that circuit the feed wires were carried back from that point along the edge of the sidewalk, as mentioned above, and into the alley where they terminated at the transformer.

Our company started putting all of this "White Way" lighting on one circuit, but it developed into so many complications that we finally decided that the cheapest and best way out of it would be to put a meter on every ten standards, in other words, one meter for each circuit, so we now have the system connected up in this way. The city maintains the lighting system and pays us for the current as registered by the meters installed.

A fact that may be worth mentioning in connection with this work was the difficulty which we experienced on account of the many awnings in our way which were almost impossible to have removed.

The photographs which accompany this article were taken at midnight and the illumination is not as good as it would have been if taken earlier in the evening on account of the electric signs being turned off and all of the stores being closed, however, it shows the general ef-



TYPE OF LAMP-POST USED IN FORT WORTH.

fect of the "White Way" lighting very well.

We have just completed this installation of the "White Way" lighting and are now putting all of the other wires in the fire district underground, and in a short time all of the poles shown in these photographs will be removed and the streets will have a much better appearance.

The fire and police alarm wires are run in the telephone underground cable, and brought out of the telephone company's manhole and carried in underground conduit over to the "White Way" standard on the corner.

Lighting Fixtures in Wood and Art Glass

A New Departure in Electric Lighting Fixtures Rich in Possibilities

The saying that "history repeats itself" is verified in the use of wood in the construction of modern lighting fixtures. The prototype of the chandelier was a simple cross or circular band of wood suspended from the ceiling by chains, and serving as a sort of hanging shelf upon which were placed candles or oil lamps. As the arts of metal and glass working developed, the crude wooden fixtures were replaced with the more elegant and elaborate constructions of these two materials.

The commercial introduction of illuminating gas about a century ago necessitated a metal construction, the general lines of which closely followed the precedent set in the fixtures designed for holding candles. The electric lamp, though absolutely revolutionary in its method of producing light, was merely adapted to the fixture construction which had been in vogue for centuries; and we are only just beginning, at

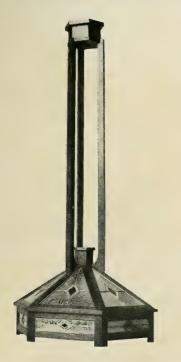


FIG. I .- A DOME IN OAK AND ART GLASS.

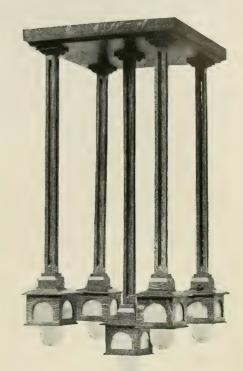


FIG. 2.—A "SHOWER" IN WOOD, WITH ART GLASS AND PRISMATIC GLOBES.

this late date, to utilize the extreme adaptability of this light-source in the design and construction of fixtures intended for its use. The electric lamp differs radically from the candle and other flame sources in having no exposed heated surface, and hence may be placed in proximity to inflammable materials with perfect safety. It also differs essentially from gas in requiring no closed tubes for the conduct of the luminant, and in being subject to control from any distance. The necessity for the continuous tube has been replaced by the simple condition requiring a small metallic wire and an insulating material. Theoretically, then, the proper material for the construction of an electric lighting fixture is not metal, which is an electrical conductor and therefore a source of dan-

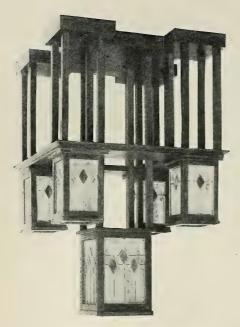


FIG. 3.—A "SHOWER" OF LANTERNS.

ger, but an insulating material. Among such materials dried wood holds a position among the best, and glass perhaps best of all. From the mechanical standpoint, therefore, wood and glass are the most logical materials for electric fixture construction.

Let us next consider the lighting fixture from the artistic or decorative standpoint. As has often been stated before, a lighting fixture is either a part of the structure or a part of the furnishing; in the smaller building, especially the average dwellinghouse, it is undoubtedly to be considered as an element of the furnishing, in which case it must harmonize with the furniture and decorations. Now, with very few unimportant exceptions, wood is the material used for the construction of furniture, forming the framework or foundation even in those pieces in which it does not appear. What is more natural and appropriate, then, than that the lighting fixtures be constructed of the same material? In view of these facts the only reason that can be ascribed for the comparatively rare use of wood for this purpose is the power of custom. Necessity so long required the use of metal construction for lighting fixtures that it became a

habit, which the radically different electric light has been unable to overcome in the more than a quarter of a century of its existence.

But while custom and habit are powerful influences, they cannot forever hold against progress and improvement; and there are distinct evidences of a growing tendency to get away from the old idea of the metal chandelier and side bracket as predominant lighting fixtures. This tendency is being sustained, if not accelerated, by the gradual change in architectural fashions. The classical and mediæval principles and habits of architecture that have so long held absolute sway are showing signs of losing their hold upon the public mind, and original conceptions, arising from modern structural conditions and social characteristics, are taking their place. This new line of thought has found concrete form in the styles of art applied to building which are variously classed as Arts-and-Crafts and Art Nouveau. buildings or interiors conforming to these new schools of art the wooden fixture is not only permissible, but the most appropriate, since it embodies both the letter and spirit of these artistic conceptions. basic motive in Arts-and-Crafts is individuality, not only in the conception of the design but in its actual execution. It is not the assembling of parts made by different individuals or specialized machinery, but the result of the efforts, both manual and mental, of a single individual; such at least is the theory of this school. Its results typify the labor of love, the love for creating material forms that express



FIG. 4.—A CEILING PLAQUE WITH DECORATIVE LANTERNS.

the creator's ideas of beauty, as well as his mechanical skill. The wooden lighting fixture conforms fully to these ideals.

With this general discussion of the subject, let us now turn to the examination of a few examples. In Fig. 1 we have a type of fixture which has justly achieved great popularity. There is probably no other kind of fixture that gives quite so good results in illumination for the diningroom or library table as the so-called "dome." When properly designed and constructed it affords an even and well diffused light over the table, shields the eves from the direct rays, and gives a sufficient illumination on walls and ceilings to prevent a feeling of gloom. The fixture here shown is constructed of quartered oak, which may be given any finish to correspond with its surroundings, and may be fitted with either plain panes of art glass with any desired color tone, or of leaded panes, as shown in the illustration. A translucent reflector giving a fairly large proportion of transmitted light should be used in connection with a single tungsten lamp.

Fig. 2 is an example of the type of fixture that has also become popular within the past few years, known as the "shower." The use of the prismatic globe in connection with the art glass windows in the wooden shades is certainly an ingenious arrangement, but one which we can hardly commend from the illuminating engineering standpoint. If the lamp is placed sufficiently low in the prismatic globe to give the correct distribution the illumination of the art glass must be rather dim. However, this is a minor point which could easily be changed without de-

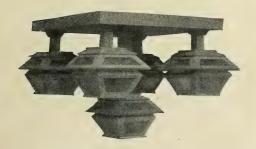


FIG. 5.—A CEILING FIXTURE OF UNIQUE CON-CEPTION.



FIG. 6.—A TREATMENT BOTH DECORATIVE AND EFFICIENT.

tracting from the general effect of the fixture.

Fig. 3 is a very original modification of this type of fixture, and an excellent embodiment of the accepted principles of the new schools of design. In point of efficiency of illumination the illuminating engineer would find much to criticise, but the user or designer may well retort that Oriental rugs are far less efficient floor coverings than rag carpet or Chinese matting; but still they are frequently used. There is no question, however, as to the possibility of producing all the illumination from this fixture that would be required under any conditions in which it would be suitable for use, and this is more than could be said of all the metal fixtures that are designed for similar purposes. If one chooses to enjoy the beauty of illuminated art glass, and has the ability and the will to pay for it, who shall say him nay?

Fig. 4 is another modification of the "shower," or perhaps may be considered as a suspended ceiling placque. This is not open to criticism from the illumination standpoint, but combines the elements of utility and beauty in a very happy manner.

Fig. 5 would probably be described by almost every observer offhand as "odd." The lantern construction of the shades is certainly unique.

Fig. 6 is a combination ceiling fixture which suggests the metal fixture some-



FIG. 7.—FOR THE LOW CEILING ROOM.

what in the suspended lanterns, although the construction is clearly consistent with the material used.

Fig. 7 is an entirely original conception, and is especially useful for low ceilings where the lamps would be more generally concealed.

Fig. 8 is a more massive fixture, intended for use in churches or for any large rooms. It is of the chandelier type, but sufficiently declares its wooden construction. The large shades were originally intended to enclose clusters of lamps, but the better construction now would be the use of a single lamp in a translucent reflector, in which case the fixture would give all the efficiency obtainable in connection with the decorative feature of stained glass.

While all the fixtures shown in these examples are of quartered oak, it is evident that any other wood could be similarly used. Oak, however, is used almost exclusively in Arts-and-Crafts furniture and interior finish, and hence it is natural that it should be chosen for lighting fixtures.

In all craftsmanship—by which we mean the treatment of utilitarian objects from an artistic standpoint, in distinction from purely mechanical or engineering construction—the nature of the material must be carefully kept in view, and the structure made to conform to basic mechanical principles. For example, where wood is the material used the grain must always run the longest way of the piece. This, by the way, is a principle which is outrageously violated in certain styles of veneered furniture which have been much admired, in which the edge of a board, such as the top of a table or bureau, for instance, will be veneered with the grain running crosswise, a condition which no cabinet-maker would for a moment consider using in the solid material, and which, therefore, openly proclaims the sham.

The imitation of metal construction in wood is another sin against the same general principle. Wood has its own particular beauty and its own limitations, and the former can be realized to the full only by a complete observance of the latter. In the fixtures herewith shown the principles of wood construction have been very generally followed in a conscientious manner, with the possible exception of the attempt to produce a chain effect, and this may be excused for the reason that the construction is in reality a comparatively simple and efficient one. The large chandelier follows the most closely metal construction, although the structure is strictly consistent with cabinet work; the absence of a strengthening brace for the arms, however, would probably catch the eve of the careful mechanic.

There is no doubt that the monopoly which metal has held in the lighting fixture industry has had its day, and that wood, glass and porcelain are to compete with this time-honored material, just as silk, paper, shell and bead work have competed with the traditional blown glass shade; all of which will add to the scope of the work of the fixture designer and maker, and the student of the science and art of illumination.



FIG. 8.—A CHANDELIER OF INLAID OAK, SUITABLE FOR A LARGE INTERIOR.

Light in the New Vanderbilt Hotel, New York

A Gratifying Example of American Art and Craftsmanship

The Vanderbilt adds another to the list of New York's palatial hotels, of which the end seems to be no nearer reached than in the making of many The building is a magnificent twenty-story structure, occupying an entire block of frontage on Fourth Avenue in the Murray Hill district. The architecture is distinctly Italian Renaissance. The interior decoration and construction is in very decided contrast with the ponderously gorgeous effects that have been so much sought for in the older structures. Elegant simplicity is the keynote of the furnishing and decoration. This is shown in the photograph reproduced in Fig. 1, which is a view of the lobby and dining room taken from one of the balconies. The ceiling is vaulted on low elliptical arches, the masonry of the

arches and pillars being uninterrupted. The material is an exact simulation of light buff sandstone pointed with white mortar. The only architectural decoration is a frieze, dull gold, above which are bas-reliefs after the manner of Della Robbia. The floor is of marble, which has rich tones of brown and maroon; the rugs and tapestries of dark blue.

The lighting installation is noteworthy as displaying the perfection to which the art of glass making has been brought at the present time, and the extent to which it is used in the design of the fixtures. In the view shown the chief sources of illumination are the massive crystal chandeliers which are suspended from alternate vaults in the ceiling. Each of these contains twenty-four tungsten lamps, which are so arranged as to be



FIG. I.-LOOKING TOWARD THE MAIN DINING ROOM FROM THE BALCONY.



FIG. 2.-A CORNER OF THE WRITING ROOM.

entirely hidden by the glass decoration. It is scarcely possible to conceive anything more brilliant, without being simply glaring, than these magnificent specimens of crystal fixtures. To the pillars are attached exquisitely wrought bronze brackets supporting vases from which there are flower-like sprays of small electric bulbs, which are stained a deep golden yellow. These add a warm note to the general color scheme and serve as decorations. An ideal reading light is provided by special bronze brackets fitted with Linolite lamps and reflectors placed just above the chairs which are about the pillar. Other subsidiary and decorative fixtures are used in the form of vases from which spring graceful flower-like forms supporting either electric candles or bulbs, and ceiling bowls under the galleries.

A view in the writing room is shown in Fig. 2. Brackets supporting candelabra are attached to the pilasters and

supply a moderate general illumination for the room, while especially designed brackets equipped with Linolite lamps are attached to the pillars and afford the proper light for reading and writing.

Fig. 3 is a view of the grill room. The columns and vaulted ceiling are entirely in terra cotta showing grayish white and Delft blue. The illumination is by large globes suspended from heavy bronze brackets placed at the top of the pillars. These globes are of special design and are an exact representation of finely carved alabaster. Ceiling placques of the same character are used under the balconies.

Fig. 4 is a view in the lobby looking into the writing room on the right and the buffet on the left. The illumination here is semi-indirect, the alabaster-like placque reflecting a considerable amount of the light to the ceiling, which, by the way, shows the stains due to a mishap which occurred shortly after the building

was opened. Handsome bowls of the same material are used to light the registry desk and other business departments under the balcony in the lobby.

If a referendum could be had to decide what is the most beautiful material for transmitting light for illuminating purposes, the returns would undoubtedly show a handsome majority for natural alabaster. This material, unfortunately, is extremely expensive, owing to the difficulty of obtaining flawless pieces of sufficient size, and even when pieces apparently flawless are obtained they sometimes prove unequal to the strains of contraction and expansion due to the differences in temperature when the lights are on and off. A disastrous case of this kind is reported in connection with the new C. & N. W. Terminal in Chicago. While there may be a legitimate objection to imitation in art, it must be remembered that, as in the case of science, the theory cannot be fully realized in practice.

Thus, while veneering is the very type of cheap imitation, it is an absolute essential in the manufacture of some of the finest pieces of cabinet work, as, for instance, piano cases, which, if made of the solid wood, would warp and check and soon become disfigured and useless. It is generally conceded that an imitation must be so close as to practically defy detection, in which case it produces exactly the same effect as the thing imitated; or it must openly declare it is an imitation, in which case it may be more properly called simulation.

The glass referred to in this lighting installation justifies its use in connection with the highest degree of decorative art on the ground of its absolute imitation of real alabaster; in fact, the writer was unable to satisfy himself which material was used without feeling of a globe to determine its thickness. There is probably not in this country, and, perhaps, not in the world, so fine an example of the perfec-



FIG. 3 .-- A SECTION OF THE GRILL ROOM.



FIG. 4.—IN THE LOBBY, LOOKING TOWARD THE WRITING ROOM AND BUFFET.

tion to which the art of glass making has been brought as in the illuminating glassware used in the Vanderbilt Hotel.

In the purity and brilliancy of the glass itself, and the perfection of craftsmanship, the crystal chandeliers easily surpass any of the famous pieces that were made in the periods of the Louis in France, which have served for models for all time since, while the bowls and globes simulating alabaster are unique specimens of modern ingenuity and skill in the art of glass making. While the glassware forms the more conspicuous part of the installation, the bronze work is no less worthy of praise, both for the excellence of the design and the perfection of workmanship which it exhibits.



Lighting London's Subway Stations

An Interesting Example of Underground Railway Lighting

By a LONDON CORRESPONDENT

At the last meeting of the Illuminating Engineering Society in London a paper on "Railway Lighting" was read by Mr. Haydn T. Harrison, in the course of which a considerable amount of information bearing on the illumination of platforms, goods, yards, etc., was given. Mr. Harrison also made the proposal that a

minimum illumination of 0.25 foot-candles should be aimed at and provided in all stations of any consequence.

In the discussion interesting confirmation of this suggestion was given by Mr. Dar in a series of comparative measurements of illumination on tube railways. The conditions of illumination differed



FIG. 1.—SEMI-INDIRECT LIGHTING WITH TUNGSTEN LAMPS AND OPAL BOWLS,



FIG. 2.—A STATION BY NIGHT-AN OASIS OF LIGHT IN A DESERT OF GLOOM.

in many respects, but the minimum illumination was almost invariably over the above minimum. On the other hand, the uniformity of the illumination differed very much, one of the most successful installations in this respect being that at British Museum station, where, by Holophane reflectors spaced about 25 ft. apart, an average platform illumination of 1.2 and a minimum value of just over 1 footcandle was secured.

The accompanying illustration shows a somewhat novel method of lighting at Golder's Green station on the Charing Cross & Hampstead Tube Railway. The new station is not yet opened to the public and is, therefore, seen in some disorder. But it will be observed that the booking hall is lighted by indirect opal units with tungsten lamps. The consumption is about 0.5 watts per square foot of floor area, and the general illumination about 0.5 foot-candle. This method of lighting is being adopted on certain stations of the underground railways, with a view to avoiding glare and producing a restful

and ornamental effect. In the background will be seen a passage lighted by concealed lamps in a somewhat novel manner. Slots are cut in the roof and whitewashed inside and the lamps placed therein. People going down the passage are, therefore, unable to see the actual sources of light and be dazzled by them.

The second illustration (like the first, taken entirely by the light of the lamps seen in the picture) shows the outside of this station by night. The brightly lighted booking hall and entrance make a vivid contrast with the surrounding dark ex-This provides an excellent illustration of the recognition on the part of modern railway companies of the value of light in attracting passengers and for purposes of advertisement generally. This tendency in modern railway station lighting was commented upon by several of the railway engineers who took part in this discussion in London, and the Illuminating Engineering Society in that city has been very instrumental in calling at tention to the importance of this subje-

Lighting the Lunch Room

A Study in Illumination and Gastronomics

By J. M. Coles

It is said that hunger is the best sauce; but even the piquancy of this condiment cannot overcome the counter gastronomic force of unsightly food or surroundings. Appetite is more powerfully affected by psychological conditions than any other of our instincts. The most voracious appetite may be instantly overcome by a sudden emotion, as fear or sorrow, while mental suggestion may render the most appetizing and digestible viand utterly repugnant and nauseating.

The importance of having the surroundings of the place to which the public are invited to eat not absolutely free from all appearance and suggestion of careless

or unsanitary conditions, but positively attractive, needs no argument. In the more pretentious places this fact has always been duly considered, but it is only within comparatively recent times that the possibility of securing such conditions in the moderate priced restaurants has been practically recognized.

The one condition to which all others are subservient is an abundant use of light. The enormous success, financially and otherwise, of the popular priced restaurants managed by a single corporation in New York is a convincing example of this fact. The originator of this system began by not only using a quantity of light



FIG. I.—GOOD LIGHTING, GOOD FOOD, AND A GOOD APPETITE ADD TO THE JOY OF LIVING.



FIG. 2.—WHERE EYE AND PALATE ARE BOTH SATISFIED.

almost unheard of for such purposes before, but covered both walls and ceiling with white tiles, so that there should not be the faintest suggestion of darkness or shadow, even in color, anywhere within the range of vision.

The dairy lunch, or restaurant, has now become a common institution throughout the country, and its rapid multiplication and success is evidence that it fulfills a useful purpose. It is pre-eminently the busy man's friend, and the man who is not busy in this country can either lunch at his club, or must go hungry. The patrons of these popular restaurants are especially concerned with the high cost of living, a problem which is met in this ease by eliminating the "middle-man" in the shape of the waiter, and while affording all the necessities for enjoying a meal of pure food, well prepared, the expensive frills are cut out. While the necessity of using an abundance of illumination of the

best quality is thoroughly recognized, the principles of economy are not overlooked in this respect. It is therefore not surprising to find the gas arc the favorite light unit for use in the dairy lunch; good light, like good food, is not necessarily expensive.

Fig. 1 is a typical example of the better class of such restaurants. The tile floor and wainscoting, white ceiling, and modest but tasteful decoration of the walls, together with the well-kept modern cooking appliances, present a very inviting scene, which is quite as attractive under the artificial light as by daylight, the photograph reproduced being taken at night, entirely by the artificial light. It is interesting to note the two types of arc lamps side by side, the electric and the gas, the former in this case apparently being used only for emergency purposes.

In Fig. 2 we have an equally attractive example, and here again the gas are flourishes side by side with the newest form of electric lamp. That the two systems are not intended to be used in combination is conclusively shown by the brilliant illumination produced by the gas arcs alone.

The illustrations show two of the Keystone Lunch Rooms on 125th street, New

York. Each occupies the ground floor of the usual city lot. Fig. 1 shows four five-mantle and one three-mantle gas arc lamp, and Fig. 2 five three-mantle lamps. The lamps consume about 3 ft. of gas per mantle; they are fitted with opalescent outer globes.

Ornamental Street Lighting in Joliet, Ill.

The new decorative street lighting of Joliet covers ten blocks in the principal business section and consists of tungsten lamps on decorative arms attached to iron trolley poles. A daylight view of one section is shown in Fig. 1, and a detail of the pole in Fig. 2.

The lamps are run from dark until II p.m. daily, with the exception of two lights on each of the four poles at street corners, which are run all night and take the place of the arcs that were formerly used in the same manner.

The business people along the route of the decorative lighting pay \$1.25 per

foot front per year. There are ten of the four-light poles to each block, the lamps being 13 ft. above the pavement.

As will be noted, all overhead wiring, except the trolley wire, has been removed from the streets in which the decorative lighting is placed. This improvement, which is of enormous value in freeing the streets from a serious menace in case of fire, as well as in adding greatly to their apparent width and general appearance, is of scarcely secondary importance to the lighting itself.

Probably no single public improvement has so immediate and widespread an effect



FIG. I.—A LIGHTING INSTALLATION THAT IS DECORATIVE BY DAY AS WELL AS BY NIGHT.



FIG. 2.—A USEFUL AND ORNAMENTAL COMBINATION.

upon the city in general as this new type of public lighting. The conspicuousness of the improvement both by day and night cannot help but make an impression upon all beholders. The dark street looks much darker by comparison, and the make-shift lamp-post seems entirely out of place. Poor pavements and defective sidewalks show themselves in their true relief, and the unlighted store window becomes akin to a badge of mourning. Decorative street lighting is a long step toward the realization of the "City Beautiful."

From the engineering viewpoint this installation has some especially interesting features. The combination of lamps with trolley poles is unusual, although by no means unknown. While the combination pole is not so purely ornamental as the individual lamp standard, it has the compensating advantage of lessening the number of obstructions at the curb, and of a considerable economy in cost, providing, of course, that the lighting and traction companies can agree, as they did in this case. As multiple tungsten lamps are used in this installation, the question as to their ability to withstand the vibration incident to their support upon the trolley poles gave some concern to the engineers. The results, however, have fully justified the confidence shown in the present type of tungsten lamp to withstand such usage, as the breakage has been by no means abnormal. The lamps used are the 60-watt size and the poles are set 70 ft. apart.

The Hygienic Value of Gas Lighting

As Viewed by an Electrical Engineer

By Albert Scheible

One of the favorite themes on which some of our gas engineers like to expound and on which they find a ready echo among the unsophisticated is that of the alleged beneficial effect produced on indoor air by the use of gas as an illuminant. Although usually confined to generalizations, these presentations are sometimes based on tests purporting to show either an actual improvement of the air, due to the use of gas, or an effect on the same

substantially parallel to that obtained with electric lighting. However, the reports of such tests as given out by the advocates of gas lighting rarely detail all of the conditions under which the experiments were made that led to their inferences. Traced home, these tests usually prove to have been made under uncommon conditions, as, for instance, in rooms in which the lamps were placed under a ventilating hood or where the rooms had

ventilating arrangements equivalent to such hoods. Under such conditions the heat of any lamp would cause a decided upward movement of the air, and as this would be more marked with the greater heat of the gas lamps (assuming the lights used to be modern types of equal candle-power), the ventilation thus produced may be better for the gas than for the electric lamps.

This was evidently the case in the tests reported a year ago by Mr. G. Stanley Cooper in the Journal for Gas Lighting,* where the room chosen had two grate ventilators, one 8 in. from the floor and the other at the same distance from the ceiling at the opposite side of the room. Mr. Cooper's measurements showed a slightly higher percentage of carbon dioxide after three hours of lighting with tantalum lamps than with gas mantle lamps of the same candle-power, his own explanation being "that an incandescent flame raises the temperature of the atmosphere around it much more than an electric lamp does. This being so, a better circulation of air in the room would necessarily follow, and hence the carbon dioxide would be more readily removed through the ventilator." The actual percentage of carbon dioxide found by Mr. Cooper with both illuminants was small (owing to the good action of the ventilators), but whether the other products of the gas combustion left the air as suitable for continued breathing as it was when the tantalum lamps were used Cooper has failed to state.

To those not interested in exploiting gas the making of air tests in the presence of special provisions for carrying off the products of the gas combustion must seem like begging the question. For more nearly parallel test conditions a miniature electric heater or fan should have been inserted in the ventilating flue to produce a draft with the electric lighting equal to that due to the gas burners. Even then the simple CO₂ measurements would not prove much, as it is not the carbon dioxide itself, but the other products of the gas combustion, that are to be feared.

More recently Mr. R. F. Pierce,

illuminating engineer of the Welsbach Company, has again raised this question of the hygienic value of gas lighting in a strong article† in which he quotes freely from the 80-page paper of Dr. Samuel Rideal in the Journal of the Royal Sanitary Institute, of London, for March, 1908. Although this paper was based on experiments made early in 1907, Mr. Pierce implies by his comments that he considers Dr. Rideal's tests as both conclusive and up to date; yet, when closely scanned, they seem to be neither. The tests in this case were made with a fine scientific attention to details, and yet with an amazing disregard of one great essential—that of having the conditions typical of the average met in indoor lighting. This fact is all the more unfortunate, as Dr. Rideal was unusually painstaking in his efforts to secure accurate results. Thus, as an extra check he used a pair of adjoining, but separable, rooms in these tests, each having an unusual amount of door and window surface. The rooms measured only 14 x 16½ ft., but there was a wide window and a door on one of the sides, while the opposite side had two good sized windows. The total width of the door and windows (not counting a "fanlight," or transom, over the door) in one of the rooms was over 181/2 ft., or much more than the length of the room. In some of the tests this large cooling surface was augmented by opening both a fireplace and a grate in the chimney near the ceiling. The tests were made in winter, some of them on days when a strong wind was blowing; hence, in view of the difference between indoor and outdoor temperatures, there must have been an air leakage through doors and windows far greater than that commonly found in rooms of this size. The fireplace and the ventilating flue probably helped also, the former being spoken of as "blocked by a screen," which would not imply any hermetic sealing. All told, the conditions were much more favorable toward the creating of artificial ventilation by the heat of the lamps than we commonly find them in rooms in this country; hence they explain Dr. Rideal's conclusions that the

^{*} Journal for Gas Lighting, Dec. 6, 1910, Vol. 112, p. 705.

[†] ILLUMINATING ENGINEER (New York), Sept., 1911.

gas burners gave rise to stronger air currents than electric lamps, a difference easily traced by him to the higher temperature of the gas mantles. Which is merely another way of saying that, viewed as a stove, a gas lamp of a given candle-power is more efficient than a carbon filament lamp of the same candle-power, a fact which no electrical man will deny. making his tests before the advent of the tungsten lamp Dr. Rideal had to work with what we now consider a very inefficient lamp, and his results as regards air moving would undoubtedly have been still more strikingly in favor of the gas mantles if he could have compared these with the modern tungsten lamps.

Evidently this use of a now obsolete type of incandescent lamp was not perceived by Mr. Pierce, for he innocently repeats Dr. Rideal's conclusions that "the electric lamps really produced more heat than is commonly accredited to them." Little wonder, for a perusal of this remarkable paper shows that the lamps used were 25 c.-p. "Royal Ediswan" lamps of an average consumption of 98 watts each, so that they should have radiated about three times as much heat as would have come from tungsten lamps of the same candle-power. In view of this use of inefficient and now obsolete units (which, however, were compared with a modern type of inverted gas mantle lamp) it is amusing to read that "the electric light did not show the superiority in coolness usually claimed for it."

Of course Dr. Rideal's use of a carbon filament lamp of the vintage of 1906 was justified at the time of his experiments, as it represented the electrical practise of his day. However, his drawing inferences as to heat radiation from tests made in a room having an uncommon type of ceiling is not in accord with the true scientific spirit. To quote his own words: "The greater part of the heat arising from the combustion of the gas is imparted to the air which passes through the globes, emerging at a temperature of from 450 to 500 degrees F. At such temperatures it weighs barely half as much as the colder air of the room and, therefore, mounts in a steady and rapid stream to the ceiling, over which it spreads, transferring to the ceiling most of its heat. The ceiling, with its skeleton of steel joists, thus performs for the air of the room the same office as the radiator of the motor car does for the circulating water. Hence only a small part of the heat from the gas is communicated to the main body of the air."

Thus, according to Dr. Rideal's own statement of the conditions, the ceiling of the test rooms had a network of steel joists, which in cold weather served admirably as heat dissipators. Such ceiling radiators certainly are not common in this country, hence conclusions based on their use cannot be applicable to the ordinary conditions of indoor lighting as we find them in America.

Having thus overlooked both the uncommon ventilating and heat radiating features of the test room and the obsoleteness of the electric lamps used in the tests, our worthy gas advocate scores a fourth time in not noticing the reasons for the alleged superiority of gas light in its effect on the eyes of those working under it. According to Dr. Rideal's paper, the lamps were used in pairs, hung about 6 ft. above the ground and about a foot apart within a short fringe 25 in, in diameter. which could not screen those seated at the table from the direct rays of at least one of the lamps. Consequently the eyes of the test persons were subjected to the direct glare of the bare lamps. Naturally that from the lamps in which the intrinsic brilliancy of the light-giving surface was greater (owing to the much smaller surface of the carbon filament) would have a more detrimental effect on the eye into which it shone directly. That so competent an illuminating engineer as Mr. Pierce should countenance and apparently endorse tests made under such conditions is quite surprising. However, a glance at Dr. Rideal's conclusions implies that the simple substitution of a frosted bulb lamp would have inverted the comparative results obtained by him and would have shown the electric lamps to have caused less eve fatigue.

Just why the report of tests made with a now obsolete and exceedingly inefficient type of incandescent lamp, placed within the field of vision without so much as frosting the bulb, and used in a room with uncommonly good ventilating facilities, should be resurrected and quoted as if the results applied to our present practise, is hard to understand, unless our gas advocates fear to risk comparisons with the modern tungsten lamps.* In view of such glaring discrepancies between the conditions of the British tests and those met nowadays in indoor lighting practise, Dr. Rideal's painstaking work certainly cannot be looked upon as showing the hygienic comparison between the two illuminants as we now use them. Even his conclusion that no discomfort resulted from working under either class of lamps must provoke a smile when we consider that his tests were made during the months of January, February and March, when the colder outdoor air improved the ventilating effect obtained from the heat of his gas lamps. How this ventilation would have dwindled in warmer weather and how the comfort of the test subjects would have waned with it is another question. Considering the exhaustiveness with which this English investigator went at the subject, it seems doubly unfortunate that his results should have been so largely nullified, for they by no means prove what similar tests would have shown if made in comparatively unventilated rooms with tungsten lamps shielded from the direct view of the subjects. Such tests, if now repeated under normal and up-to-date lighting conditions, should have a real scientific and hygienic value for the present generation, and while our gas friends may prefer to abide by the older results, the electrical fraternity will welcome new investigations made with the lighting units now used in good practise.

Lawn Tennis Courts Lighted by High Pressure Gas

Night Playing Made as Pleasant and Sure as by Daylight

By a London Correspondent

An interesting high pressure gas installation has recently been carried out in Dulwich (near London), where some covered lawn tennis courts have been lighted artificially by high pressure gas. One of the most famous examples of artificially illuminated courts is that of the King of Sweden, in which indirect electric lighting is employed. It was at first intended to use this method of lighting in the courts at Dulwich, but owing to the necessity of allowing space for the skylight, the method was eventually not deemed feasible.

The appearance of the court is shown in the photograph taken entirely by the actual lights seen. This photograph has not been retouched in any way, and the slightness of the halation round these brilliant sources is a remarkable testimony to modern photographic skill. In passing

it is interesting to note that the time of exposure was judged by photometric means, the Holophane Lumeter apparatus being used.

The building is 158 ft. long by 134 ft. broad and contains three courts. The artificial lighting of the courts is accomplished by Keith high pressure 1,500-c.-p. lamps hung at a height of 25 ft., eight lamps being allowed to each court. Recent tests showed that the illumination over the courts was of the order of 3 to 5 foot-candles. The gas consumed by each lamp is rated at 25 cu. ft. per hour, so that with gas at 2/6 per 1,000 cu. ft. (as it is in the district of the South Metropolitan Gas Company, where this court is situated), the cost of lighting is reckoned at about 6d. (12 cents) per court per hour.

It will be seen that the courts them-

^{*}When Dr. Rideal's paper was first presented before the International Congress of Hygiene at Berlin attention was called to the fact that even at that time the rooms used in the tests were not typical of average conditions. However, these tests and the inferences drawn from them have been quoted ever since as if the comparisons had been made under normal conditions.



THE COURTS AS THEY APPEAR AT NIGHT.

selves and all the surroundings are painted a dead black. The lines of the court, the tops of the nets and the balls are white, so as to form as complete a contrast as possible. Perhaps from an illuminating engineering standpoint it might have been considered preferable to make the surroundings white and the lines and balls black. No doubt the desirable illumination could be obtained with a much smaller consumption by this means, but it is not certain that the quality of shadow obtained would be better, and it has been suggested that the monotonous lightness of the dead white surroundings would prove fatiguing.

One would hardly have supposed that with distributed light-units it would be

possible to hit the ball high and to follow its course with the eye without being dazzled. It is stated, however, that the players find no special difficulty in this respect. Special means have, however, been taken to soften the light, a plate of ground glass being placed under each lamp, which is also encased in a concentrating silvered reflector.

The tendency to provide artificial illumination for sports is interesting and welcome in so far as it provides an opportunity for participation in them on the part of people who are engaged in business all day. Possibly we may look forward to a time when football and baseball matches will be almost invariably played by artificial light.



The Centenary of the Introduction of Gas as an Illuminant

A Fitting Celebration to be Held in Philadelphia

On April 30, 1812, a charter was granted to the Gas Light & Coke Company of London, this being the first gas company organized for service to the public.

During the year 1812 David Melville built in Newport, R. I., the first gas manufacturing plant erected in this country. From these statements it will be seen that the present is in a double sense a gas centenary year.

The actual discovery that an inflammable gas could be distilled from coal, and the utilization of such a gas for illuminating purposes in a few private establishments, both here and abroad, occurred at

considerably earlier dates.

In Philadelphia, on April 18 and 19, 1912, will be held a symposium in celebration of the one hundredth anniversary of the beginning of the use of gas as an illuminant.

The celebration will be given under the auspices of the American Philosophical Society, the Franklin Institute, the American Chemical Society and the Amer-

ican Gas Institute.

The following lectures will be given: Thursday, April 18, 8 P.M., in the hall of the Franklin Institute, 15 South Seventh street—"By-products in Gas Manufacture," by Charles E. Munroe, Ph.D., Washington, D. C., Professor of Chemistry and Dean of the School of Graduate Studies, the George Washington University.

Friday, April 19, 10 A.M.—"The Commercial and Financial Aspects of the Gas Business," by Hon. George B. Cortelyou, New York, president of the Con-

solidated Gas Company.

Friday, April 19, 11 A.M.; in the same hall—"The Technic of Gas Manufacture," by Alfred E. Forstall, M.E., New York, secretary Trustees Gas Educational Fund of the American Gas Institute and past secretary American Gas Light Association.

Friday, April 19, 2 P.M., in the same hall—"Gas as an Illuminant," by Van Rensselaer Lansingh, B.S., New York, president of the Illuminating Engineering Society.

Friday, April 19, 3 p.M., in the same hall—"Gas as a Source of Heat and Power," by Edward B. Rosa, Ph.D., Washington, D. C., physicist National Bureau of Standards.

These lectures will constitute an interesting and valuable review of the development of the use of gas as an illuminant, and as a source of heat and power. Persons interested in the manufacture and use of gas from all parts of the country, members of the societies named, and the general public, including ladies, are cordially invited to attend the sessions.

An effort will be made to bring together as many as possible of the pioneers in the gas industry, those who have been engaged in the industry thirty years or more. All such are requested to send their names to the acting secretary.

A temporary loan exhibition will be held in the hall of the Franklin Institute of articles, models, appliances, books or pictures that have an historical interest. Any one who knows of such articles should communicate at once with the acting secretary, William J. Serrill, 1401 Arch street, Philadelphia.



FIG. 1.—SALESROOM OF THE MANUFACTURERS OF THE "DETROIT ELECTRIC," 687-691 WOODWARD AVENUE, DETROIT, MICHIGAN.



FIG. 2.—ONE OF SIX WINDOWS IN THE NEW SALESROOM AND OFFICE BUILDING RECENTLY ERECTED BY THE UNITED MOTORS DETROIT COMPANY.

Display Room Lighting

Theatrical Effects Secured by Proper Selection and Location of Concealed Illuminants

By Frank C. Reilly

In Detroit, the motor metropolis, more thought has been given to the artistic lighting of automobile showrooms than in any city in the country. Many of the Detroit showrooms are maintained and operated by the manufacturers, considerable rivalry existing. New showrooms are being opened every month, each manufacturer endeavoring to surpass the other in elegance of appointment, decoration and illumination.

The illuminating engineer visiting Detroit for the first time always avails himself of the opportunity of inspecting the lighting installations in the many salesrooms and invariably expresses admiration for the clever manner in which are executed the things that go to make up the beautiful group of display rooms which are typical of Detroit's progressive manufacturing and merchandising methods.

In selecting a system of lighting the architects have been invariably guided by a desire to secure for their clients an installation which would be economical to maintain, yet affording a satisfactory degree of illumination, the source of the light to be at all times concealed. The policy of laying out lighting on a hit-ormiss basis has long since been discontinued by Detroit architects, and the results secured reflect greatly to their credit.

In the showroom of the Anderson Electric Car Company, manufacturers of the "Detroit Electric," a very pleasing and artistic effect has been procured by installing tungsten Linolite on the transom bar. The interior is decorated in light tints selected with a view to enhancing the beauty of the showroom for evening display, the owners realizing that their Woodward Avenue location afforded exceptional opportunities to impress the throng of theatergoers with the merits of their electric coupes; evidently the Anderson people are familiar with the adage, "Goods well displayed are half sold."

The illustration showing the "Maxwell" window of the United Motors Detroit showroom is but one of six in their mammoth new garage, all of which are lighted with Linolite. Here also the reflector is installed on the transom bar, thus affording a display certain to arouse the admiration of all.

The windows are each 16 ft. wide, a total of but 96 ft. being required for the entire showroom. This installation was made under the supervision of J. J. Wolfenden, E.E., representing the architects, Smith, Hinchman & Grylls.

The Abbott-Detroit's display is one of the attention-compelling installations that has done much to earn a reputation for Linolite. This showroom is located on the lower floor of the new Dodge Brothers' Power Building, recently completed. The owners were particularly desirous of securing chassis illumination, so that the under-structure of their car might be carefully inspected by visitors, and to procure the required results the illuminating engineer recommended that a continuous reflector be placed on the panel beneath the window, as well as on the transom bar. The lower section of lamps is protected from damage by a brass rail similar to that used on the deck of small yachts and motor boats. This installation has been in service eight months without the renewal of a single lamp.

Visiting dealers invariably make it a point to see the Abbott showroom at night, and it is fair to assume that many of its features will soon be duplicated in other cities.

The pioneer installation of Linolite for automobile display is that of the Security Auto Company, prominently located on Woodward avenue. A single section of tungsten Linolite 40 ft. long is the sole illuminant in this large showroom, and the result is decidedly theatrical. The photograph reproduced here was taken over one



FIG. 3.—SPLENDID RESULTS SECURED BY INSTALLING LINOLITE ON TRANSOM BAR AND ON BASEBOARD BENEATH WINDOW.



FIG. 4.--TUNGSTEN LINOLITE THE SOLE ILLUMINANT, LOCATED ON TRANSOM BAR.

year after the installation was made, and at that time all but three of the lamps had been in operation from the time the installation was first made. Neither the lamps or reflectors were cleaned before the picture was taken.

The last two pictures were taken at the Ford Motor Company's Detroit service station. The Linolite here is installed on the baseboard, and the manner in which the chassis is displayed is really unique. In all there are six windows at the Ford service station, but two being here shown. The Ford Company was so pleased with this installation, which was made under the direction of their architect, Albert Kahn, that this method has been standardized for their other service stations.

In the last picture is shown "999 the second," Ford's famous racer. Never since the day of Henry Ford's 999 special racer, driven by Barney Oldfield, has a Ford car been built with the speed that this "999 the second" has been shown capable of producing. It was during the Michigan State Fair in September that Frank Kulick drove this Ford racing car around the 1-mile dirt track at the Fair Grounds in the remarkable time of fifty seconds flat, thereby beating the competing time of Bob Burman in a 200-hp. Benz racer by 1 2-5 seconds. For this performance Kulick was handed a brand new \$1000 bill by Mr. Ford, with the request that he stop breaking any more records and thereby save breaking his neck.

On February 7 Kulick, driving "999 the Second," lowered the world's record on ice by doing a mile on Lake St. Clair in 32 seconds. The previous record was held by Henry Ford who did a mile in 39 4-5 seconds, over the same course with old "999" in 1903.

In addition to the showrooms here illustrated, Detroit has a number of other prominent installations, foremost among which are the Oldsmobile, Regal, Chalmers, Elmore, Carter car, Hupp-Yeats and Thomas agencies.

During the Detroit Auto Show a number of Limousines and coupes were lighted with 4-ft. sections of Linolite so arranged as to entirely conceal the source of light. Visitors were compelled to stop by the unusual brilliancy of the car interiors, all of the conceits and luxuriousness of appointment being emphasized by the flood of light.

For displaying the sectional chassis and engine parts Linolite was very popular, owing to the ease with which it could be concealed and the advantageous distribution of light procured by its use. Hidden parts were clearly shown and the method of lighting came in for nearly as much praise as the engines and transmissions on display.

Another unusual use to which Linolite has been put by the motor car manufacturers is for the illumination of transparent signs suspended from the running board of the cars. Manufacturers of electric trucks and pleasure vehicles are using large quantities of lamps for the demonstrating and display cars which they are sending round the country-the 30-volt Linolite tungsten lamp operating most satisfactorily on current supplied by the storage battery. The lamp itself is so constructed that no trouble is experienced as a result of the vibration to which it is subjected. One of the largest users of Linolite tungsten lamps for miniature sign illumination is the Argo Electric Vehicle Company of Saginaw; their trucks with "Argo Electric" in clear-cut letters attract much attention at night.





FIG. 5.—NIGHT VIEW, THE FORD SERVICE STATION, DETROIT. LINOLITE LOCATED ON BASEBOARD, SOURCE OF LIGHT SUCCESSFULLY CONCEALED.



FIG. 6.—FORD SERVICE STATION, DETROIT, SHOWING HENRY FORD'S FAMOUS RACER, "999 THE SECOND."

Lighting the Great American Carnival

Illumination a Chief Feature in New Orleans Mardi Gras

By Louis A. Dodge

Brilliant illuminations of streets and building fronts with thousands of electric lamps, in streamers and in gorgeous designs are among the attractions offered by New Orleans during its Mardi Gras. These illuminations, artistic and splendid, have become more elaborate each year, keeping advanced as the art of public lighting has advanced and adopting every contrivance known to furnish light.

When the celebration of the close of the carnival at Mardi Gras first became a feature of the Crescent City, the only known methods of lighting were the crudest and most primitive. The tallow candle and sperm oil lamp for inside illumination and the pine torch and bonfire for outside lighting were then practically the only methods. At that time the close of the carnival was not celebrated with the magnificent street pageants and exclusive balls, such as it is now, but promiscuous and unorganized maskers formed in bands and paraded the streets on Mardi Gras day or danced weird dances about pine torches at night. From the pine torch and bonfire street illumination evolved to the kerosene lamp and gasoline torch. From these it progressed to the flickering gas jet, until the present highest development of the arc and incandescent electric lamp came into use.

Before the invention of the electric lamp the streets through which the parades passed and other streets in the central portion of the city were specially lighted



CAR OF REX, PARADE PASSING UPTOWN THROUGH ST. CHARLES AVENUE.



BOSTON CLUB ILLUMINATED, WITH BALCONY ERECTED FOR DISTINGUISHED GUESTS.

by gas, and with many colored globes, forming various designs, public buildings, private clubs, business houses, hotels and restaurants were illuminated. With the adoption of the electric light, these illuminations have changed and become more elaborate, although the gas illumination is still retained on some old buildings or used as an auxiliary on others.

Canal street, Royal street, St. Charles street and Bourbon street, the principal streets through which the parades pass are brilliant with public and private lights. In addition to the arcs, these streets are strung with streamers or incandescent lights on both sides above the sidewalks. In Canal street between six and seven thousand lamps are used. In St. Charles street about 3000, and in Royal and Bourbon some 3000 more.

This gives a special illumination along these streets of more than ten thousand electric incandescent lamps. In addition to these, it is estimated by the New Orleans Railway & Light Company that ten thousand more lamps are used in private illumination. Other electric companies also supply considerable power for many lights.

Much ingenuity is displayed in the illu-

mination of the business houses and clubs and considerable rivalry exists. The private clubs, such as the famous Boston, Pickwick, and Chess, Checkers and Whist Club, in Canal street, and the big hotels, particularly the St. Charles, Grunewald, Monteleone, De Soto, and Cosmopolitan, display the greatest brilliancy. The designs usually include that of a brilliant and many-colored crown, having its significance in the mock royalty that is part of the festival. On the Thursday night preceding Shrove Tuesday, or Mardi Gras day, the displays usually include large illuminated letters, "K. of M.," in compliment to the Krewe of Momus, which parades on that night. The following Monday night they are changed to "K. of P.," in honor of the Krewe of Proteus, and on Mardi Gras night to "K. of C.," in honor of the Krewe of Comus, that appears on that night.

The illuminations of the St. Charles

Hotel are always brilliant and usually consist of streamers of colored lights, which include the carnival colors, green, yellow and purple, reaching from the top of the building to its lowest balconies.

In illuminating the City Hall, part of which is now permanent, the city electrician met with much difficulty, but has succeeded admirably. Owing to the character of the *façade* of massive Corinthian columns the lighting of this front presented peculiar difficulties. These have been happily surmounted and now the front of the building, with the large temporary platform erected for city officials and guests and where the keys of the city are delivered to Rex, is particularly beautiful in light.

Many of the Canal street stores have displays which cost thousands of dollars and compete with those of the clubs and public buildings.

Besides the special illuminations, the



ILLUMINATED SIGN SPANNING CANAL STREET, SHOWING STREET ILLUMINATION IN THE DISTANCE.



ILLUMINATION OF CITY HALL AND TEMPORARY PLATFORM FRECTED TO ACCOMMODATE THE CITY'S GUESTS.

thousands of electric advertising signs add their share to the splendor of the nights. Spanning Canal street is a large electric sign, 40 ft. above the sidewalks, which bears the inscription, "New Orleans, the Gateway to Panama." Signs of welcome are also displayed at frequent points.

In the lighting of the magnificent street pageants the flaring gasoline torch is still used. These pageants, which cost from \$30,000 upwards, usually consist of a score of floats bearing tableaux and the maskers who later join in the revelries at the carnival balls. Although attempts have been made to supplant the gasoline torch with calcium lights and electricity, they have not been successful, and the old gasoline torch has never been discarded, perhaps because of its picturesqueness and its adaptability. Indeed, it would be regarded as a desecration by the older residents of the city were the organizations

to turn to any other method of illumination. Although the streets through which the parades pass are brilliantly lighted, the glare of the gasoline torches surrounding the floats predominates, and these, with calciums and red lights, roman candles and rockets, mark the approach of the parade, the route of which can be traced by the red reflection in the skies.

Each of the tableaux, that are borne on massive floats drawn by four mules, is illuminated by its special band of gasoline torches. These torches are carried by negroes who wear bright red dominoes which glare in contrast with their black faces. The mules of the floats are similarly caparisoned in red cloth. The torches have each about a dozen jets, arranged horizontally in a bright metal reflector which throws the light on the tableau which they surround. The gasoline is supplied from a tank at the top of each

pole carrying the torch. As each float or tableau is surrounded by a score or more of the torch bearers and bands of others march between, lighting the transparencies and title cars, and platoons of torch bearers precede and follow the parade, the effect of this glaring light thrown on the floats and the maskers in beautiful costumes cannot be vividly imagined, but is sufficiently and lastingly impressive when seen. In addition to the torch bearers there are platoons

of men firing roman candles or burning red lights, which add to the glare from the torches.

There are now at least three carnival organizations which parade with tableaux at night, each on a different night, and the rivalry of one to outdo the other is intense. Usually some special subject is selected for the theme of the pageant and each tableau represents a portion of the theme.

Improving the Lighting in a Church

How an Old Time Gas Installation Was Brought Up to Date

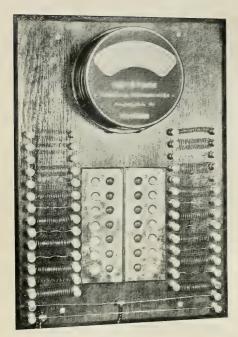
By R. F. PIERCE

There are many fine church edifices in this country that were erected before the days of modern lighting appliances. The problem of bringing the illumination up to modern ideals and practice is therefore one which frequently confronts the church authorities.

The case we have before us is All



VIEW SHOWING EFFECT OF NEW GAS ILLUMINATION, ALL SAINTS' CHURCH, BROOKLYN, N. Y.



SWITCHBOARD, CONTROLLING THE LIGHTING OF THE CHURCH.

Saints Church in the Borough of Brooklyn, New York City. The old-time system of illumination consisted in a row of gas flames running along the cornices at the base of the clear story, supplemented by eight tips around the capital of each column. It requires no great stretch of the imagination to conceive how unsatisfactory, both in the amount of illumination furnished and the excessive glare of the wavering gas jets, such lighting must have been. When the question of replacing this antiquated system came up, the church officials were skeptical as to the possibilities of gas as an illuminant, and decided that its use would not be retained unless satisfactory results could be secured at a small cost. At this point the engineering skill of the local gas company was applied to the problem, with the result shown in a general way in the photograph reproduced in Fig. 1.

The fact that this large number of flames, which produced but a dim illumination, have been replaced with an installation consisting of but four modern inverted mantle gas lamps projecting from each of the capitals is a striking illustra-

tion of the enormous strides that have been made in gas illumination.

A feature that will be still more surprising to the average reader, however, is not indicated in the photograph. This is the method of controlling the new gas lamps. The system used in the present case is a simple and reliable electrical device by which the lights are turned on or extinguished by the simple pressing of a button, each group of lamps having its own switch. The operating mechanism is shown in Fig. 2. There are two buttons for each group of lamps; pressing one turns on the gas and ignites it, and pressing the other turns it entirely off, no pilot flames being used. Besides the entirely satisfactory character of the illumination produced, both in quantity and quality, the new system possesses all the convenience of control of any modern illuminant.

A simple substitution of a new form of lamp on a part of the outlets originally provided may not seem to call for the expert judgment associated with the idea of engineering. Even the most skilled surgeon, however, is by no means entirely occupied with major operations. His experience and judgment may equally come into play in removing a mote from the Without utilizing the general knowledge and experience of modern illuminating devices which the illuminating engineer should possess, the remodeling of the lighting in this case might easily have involved an expensive new installation necessitated by a change of illuminant, and very possible with a resulting illumination less satisfactory to the congregation than the one here shown. If engineering, as has been said, consists in doing for one dollar what the uninitiated could not do for two, then the work done in this case must undoubtedly be set down as an engineering operation, albeit a minor one.

It is also interesting to note that when the church authorities were shown what could be accomplished with modern gas lighting appliances they willingly consented to the expenditure of a considerably larger sum for the remodeling of the installation than had first been contemplated.

EDITORIAL

Light vs. Illumination

In an article on "Good Reading Lights -and Bad Ones," in our December issue, the statement was made that "it is not the light, but the manner of its use that consitutes the difference between good and bad lighting." With this statement the Acetylene Journal, Chicago, takes issue, stating that "the conclusion by no means tallies with the common experience as affecting the human nervous system, or with the views of persons qualified by widest observations to speak intelligently thereon." In corroboration of these views the following quotation from a report made by a factory inspector in England is given:

The continuous use, especially on foggy or dark days, of electric light has had, I feel sure, very injurious effects on the eyes of the workers, especially where there is a tendency to weakness. Over and over again I have noticed the strained look in the eyes of the workers who have to use it for many hours at a time, or in rooms where the lights are not sufficiently screened. The number of workers obliged to wear glasses may also depend on the fact that electric light is in constant use in schools, a large proportion of those whom I have questioned having told me that they suffered from weak sight before leaving school.

This evidence is by no means convincing, since there is no explanation of the manner in which the electric lamps were The observation that the lights were "not sufficiently screened" suggests the cause of the evils complained of, which is due to ignorance on the part of those who ought to know better. Briefly, it is the failure to distinguish the difference between light and illumination; the electric lamp is hung up without any diffusing globe or reflector, and in such a position that it can shine directly into the eyes of the persons using the light, and then the electric lamp is blamed for being hard on the eyes.

The conclusion that the large number

of workers wearing glasses is due to the use of electric lighting in the schools is without justification from the observations given in the report, and is simply the wild statement of an inspector—who in this case happened to be a woman—who is apparently unfamiliar with the most elementary principles of illuminating engineering.

We will wager a life's subscription to this magazine that the lighting installations in the schools complained of will be found to consist of electric lamps, sparsely scattered about, without any protecting shades, and giving an intensity of illumination far below that required for comfortable study, and the same conditions exist no doubt in the factories and workshops complained of. Such conditions are not infrequent in this country; and unless all reports are misleading, lighting conditions are very much worse in England than here.

The electric incandescent lamp, the gas mantle and the luminous flame, whether produced from oil, gas or acetylene, all give out radiations that are practically identical, and consequently must have the same effect upon the eyes, provided that they reach the eye with the same degree of diffusion and are maintained with equal steadiness.

The light from the electric lamp properly diffused upon the visible surface and with the direct rays cut off from the field of vision would unquestionably be far easier upon the eyes than an unshaded acetylene flame giving the same intensity of illumination on the visible surface, but placed so that its light could shine directly into the eyes. On the other hand, the shaded acetylene flame would be less harmful to the eyes than the exposed electric lamp.

There is a large field in which acetylene is available for lighting where electricity cannot be supplied, and it gives an illumination equal to the best. Thus, humanity can have the advantage of the best modern illumination, whether situated in the remotest section of the country, or in the midst of the largest city.

There is no one light source at the present time that has a monopoly on quality of resulting illumination; the latter is wholly a question of intelligent use of the light produced.

Government vs. Private Ownership of Public Utilities

The distribution of wealth is not only the paramount question for the politician and sociologist of to-day, but has been so since the dawn of civilization, and will continue so to be as long as civilization endures—unless the essential traits of human nature shall change. That all men are created equal with respect to rights and opportunities is a beautiful theory; that no two men are created equal in their ability to meet opportunities is a fact as patent and uncontrovertible as the force of gravity.

From this fact it inevitably follows that wealth, which is the permanent accretion of human labor, becomes unequally distributed. How to prevent such unequal distribution so as to avoid extremes of poverty and riches, without suppressing the individual to an extent fatal to his higher development, is a problem which has caused more discussion, agitation and political and social revolutions than any other single question with which civilized

society has had to wrestle.

Much alarm has been felt in this country in recent years on account of the many enormous aggregations of wealth controlled by small numbers of individuals. How to correct the fault, if such it be, that has already developed, and how to prevent its continuance, forms the root, stem and branch of all political and social controversies of the present time. Questions of tariffs, taxes, currency, the high cost of living, the conflict between labor and capital, the very principles of government itself, all simmer down to this one fundamental proposition. Until every man actually obtains what he thinks he is entitled to this question will exist.

At present there are two general solutions offered. The one would endeavor

to secure the highest possible degree of equality of opportunities and reward for services by statute laws. Briefly stated, the theory of this solution is to preserve natural competition—which is the law of the "survival of the fittest" applied to human activities—to its fullest extent. This remedy is being tried by the National Government in its efforts to disintegrate the "trusts."

The other remedy is for the Government itself to assume the general management of the wealth producing agencies—*i. e.*, commerce and industry.

The two schemes proposed are thus diametrically opposite in theory; the one seeks to exalt the individual, the State being considered simply a collection of units, each working out his own salvation with the greatest possible freedom; in the other the individual is fused into a common mass called the "Government," in which the individual is but an indistinguishable grain of constituent material.

Personally, we have not a moment's hesitation in choosing between the two propositions. We should much prefer to live with some decent tribe of savages, relying upon our own individual efforts for food, clothing and enjoyment, than to be one of an exaggerated human anthill called the "State," or "Government." Our creed in this matter is short: We do not believe that the Government should do anything that can be done by individual effort. This restricts the function of government to the protection of the individual in his right to life, liberty and the pursuit of happiness, which involves security from individual infringement of these rights by his fellow-citizens, and collective infringement from other nations or

From this broad generalization let us take a single example. The production and distribution of gas or electricity is a business which can be successfully carried out by the individual, as thousands of cases attest. We do not, therefore, believe that the conduct of such a business is a proper function of government.

Let us see how it works out in practise. Where the business is carried on as a private enterprise the factor of human greed—which is a positive virtue except

when perverted—will result in an effort to extend the use of the product as far as possible. Now, gas and electricity are some of the fruits of modern science, the use of which is a distinct gain to humanity, and the more they are used the greater the gain. Their use produces comfort and pleasure in itself, and saves human energy, which is equivalent to saving life, and to save life is to prolong it. In order to secure the largest use those interested will not only offer their product for sale, but will give their patrons assistance and advice in using their commodity to the best advantage; in other words, they will furnish service as well as merely sell a commodity.

To put the matter in colloquial form: the private company says: "I have gas or electricity which I shall be glad to supply you at what I consider a fair price. It is a good thing. It produces better light and heat than the old sources, and adds to the joy of living. I can show you a hundred ways in which it will be serviceable. If you buy my product I will see that it is delivered without interruption, and will give you at all times all possible help in using it to the best advantage, because I know that the more intelligently you use the product the more of it you will consume, and that if you are satisfied you will probably induce your friends also to use it. My ultimate object is to make money, and the way to make the most is to give the best product and the best service at a fair price. Furthermore, I know that if I try to maintain an excessive price, or give bad service, some other firm or individual will take advantage of the opportunity to set up a competing plant.'

The manager of the government-owned plant says: "My only concern is to see that the gas or electricity is made and delivered to those who wish to purchase. It is nothing to me whether they buy much or little. Furthermore, my responsibility ends when I have delivered my goods at their destination, which is the outlet on their premises. We are not running business for profit, and we don't care a rap whether you buy from us or not; but if you do buy it is up to you to use the gas or electricity as you see fit."

Which, think you, of these two condi-

tions is the more likely to develop the individual and the community?

The Smoke Nuisance

Pittsburgh has long enjoyed the reputation of being the smokiest city of its size in this country, if not in the world; and this reputation has been more justly earned than some of its later notoriety for social irregularities. More or less effort has been made for years to abate this nuisance, but, while some progress has been made, the time-worn saying that "you can make a smokeless city of Pittsburgh, but you will have to destroy her industries to do it," has become an article of faith in the Pittsburgh manufacturer's Although modern science has clearly demonstrated that smoke is both wasteful and unnecessary, the captains of industry have refused to be converted.

However, there is a streak of light in the East, figuratively speaking. This is pre-eminently the age of investigation; any subject now that doesn't get investigated by some government commission, or social organization, or magazine writer, is of too little importance to be given a second thought. Pittsburgh possesses a University, and this University maintains a Department of Industrial Research, and this department proposes to investigate the smoke nuisance from the ground up, and from the sky down, as the following letter, which we have recently received, indicates:

February 15, 1912.

ILLUMINATING ENGINEER,

NEW YORK: Gentlemen.-It may be of interest for you to know that we are entering upon a study of the "Smoke Problem" in the broadest possible manner.

We are taking the following as our chief lines of investigation: the effect of smoke on health, plant life and buildings. We are also considering the increased cost of living, due to damage and dirt caused by smoke, and the legal as well as the engineering side of the question. Each of these investigations will be carried on by one or more men, each a specialist in his line.

It is hoped that by co-ordinating these various researches it will be possible to obtain some valuable technical as well as scientific data. We will at least be able to establish the status of the problem, as a whole,

on a scientific basis.

I am writing at this time to see if you will not aid us in this undertaking by making mention of the work we are doing in the columns of The Illuminating Engineer. We should like to get in touch with people who are interested for the purpose of co-operation, information and suggestions.

Thanking you in advance for any aid you may see fit to render us, I beg to remain,

Very truly yours, R. C. Benner.

Pittsburgh seems to be the dog chosen for sociological and economic vivisection. It was very prominently "surveyed" a few years ago at the instance of a New York philanthropic foundation, and much interesting information as to the prevailing market quotations on the legs, arms, eyes and lives of workingmen secured. Now it proposes to investigate itself in regard to its most widely known characteristic.

There is no single subject of anything like equal importance to all cities west of the Allegheny Mountains as this question of bituminous coal smoke, for there is not a city between the two great mountain chains of the continent that is not befouled and rendered uninhabitable to people accustomed to cleanliness by this common curse. If the University of Pittsburgh can succeed in solving this problem, or even in materially alleviating the nuisance, it will accomplish a greater good in improving living conditions in our cities than any political reform or scientific investigation with which we are acquainted. The investigation should receive universal co-operation, and unlimited financial support.

The discussion of this subject may seem foreign to the field of this magazine, but such an opinion would be due to superficial observation. In no one respect does the smoke nuisance make itself more quickly or unceasingly felt than in the maintenance of artificial lighting installations. Without incessant attention all lighting glassware and accessories become almost useless; and the common use of

the best devices, both from the economical and artistic standpoints, is well-nigh prohibited by this infernal smoke nuisance. One needs only to go to bed in the condition of one seeking equity—with clean hands—and with clean bed linen, and arise in the morning to find one's hands give the wash water an inky hue to realize what the condition of lighting glassware or accessories will be after a few days' use in such an atmosphere.

Success to the Smoke Problem Investigation of the University of Pittsburgh!

The Patent Question

A recent decision of the Supreme Court of the United States defining the rights of the owner of a patent has at last brought the whole subject before the people in such a manner that it seems destined to result in the long and much needed

overhauling of our patent laws.

Inventors and manufacturers have long recognized the outrageous abuses which have crept in under our antiquated patent system, and repeated efforts have been made to have the matter acted upon by Congress; but not being a political issue, it has invariably been sidetracked. The prominence of the "trust" problem, with which the patent situation is intimately connected, and this recent Supreme Court decision, has at last thrown the subject squarely into the political arena, and the fight is already on.

Briefly, the decision referred to upheld the right of the owner of a patent to specify any conditions he pleases regarding the sale and use of the article covered by the patent. This is a perfectly logical deduction from the law as it stands and is by no means the principal source of the abuse of the patent monopoly. It is to be hoped that the patent laws will not be hastily patched up, but will receive the careful and dispassionate consideration which their importance demands.

TECHNICAL SECTION

The Relation of Visual and Illumination Efficiency to Lighting Glassware, and Color of Walls and Ceiling

This fundamental and highly important subject was discussed at length, even into the small hours of the morning, at the last meeting of the New York Section of the Illuminating Engineering Society. The basis of the discussion was a paper presented by Messrs. A. J. Sweet and L. C. Doane, having the title "The Choice of Reflector: Its Influence Upon Illumination Efficiency and Depression in Visual Function." This is one of the most elaborate papers that has ever been presented to the society, being a report of experiments which have been in progress for well on to a year. The general object of the investigation is the most important, in fact is the final end and object in illuminating engineering-i. e., to determine the conditions which produce the greatest visual and physical efficiency in artificial lighting.

It would be expected that a paper reporting a series of investigations conducted upon entirely new lines, and pertaining to so important a matter, would be subjected to the most critical dissection, and no one was disappointed in this expectation. Criticism of a scientific hypothesis, of the experimental methods used to verify it, and of the conclusions drawn from the results obtained are absolutely impersonal and should therefore be merciless in their vigor. It is only by such criticism that the truth can ultimately be determined. The paper was justly praised for the large amount of careful and conscientious work which it evidenced on the part of the authors, and the exceptions taken were based upon purely scientific grounds. It must be considered, therefore, one of the most important papers that has thus far been produced, and this would hold even

if all of the authors' conclusions were later demonstrated to be erroneous, its value lying in the fact that it is a pioneer effort along lines in which there is the most urgent need of investigation. If it did nothing more than to draw active attention to the problems involved, it would serve an exceedingly useful purpose. It is more for the sake of discussing these problems than of either accepting or rejecting the authors' methods and conclusions that we wish to consider the subject of the paper.

"Depression of Visual Function," or Visual Efficiency

It will be noted that the title involves the determination of two distinct, though related, problems: the relation of reflectors to illuminating efficiency and their relation to visual efficiency; or, to use the authors' expression, "depression in visual function." We may observe here that this seems a clumsy expression involving the use of unnecessarily technical words. Visual efficiency would be understood by the layman, from his conception of the two words, to signify the amount of physical and mental effort required for continuous vision. The highest visual efficiency is obtained when continuous vision of the desired sharpness or acuity is maintained with the least effort, and consequently with the least fatigue. We can no more expect 100 per cent. in vision than we can in a machine; that is to say, all vision requires muscular, nervous and mental energy, and must therefore produce fatigue, dependent upon the time during which and the conditions under which it is carried on. If the fatigue follows the use of the eyes very quickly, the authors call the result "ocular discomfort," while "depression in visual function" is the less immediate evidence of strain and fatigue. In general effect, however, they all come to the same thing, which may be properly included in the term "-visual efficiency."

CLASSIFICATION OF REFLECTORS

The experiments were restricted to the use of reflectors which the authors classified into several groups. To this classification we take one exception. Glass of the type first introduced under the trade name of "alba" is classed along with the wellknown opal type of glass. We have previously called attention to the need of a generic term covering this new type of glass, which is both physically and chemically quite distinct from opal, in that the former owes its white color to visibly large particles suspended in a matrix of transparent glass, while the latter consists of particles invisibly small, even under the microscope, suspended in a similar matrix. The effect of the two types of glass upon the reflection, transmission, and absorption of light is also materially different.

The experiments were carried out in a rectangular room, 13½ x 23½ ft., with a ceiling height of 10 ft. 4 in. The room was divided into twenty imaginary rectangles of equal area, the centers of which were taken as the test stations. tensity of illumination upon a horizontal plane 30 in. from the floor was taken on each of these stations and used as the basis for determining illuminating efficiency. The correctness and adequacy of this method is assumed by the authors to be unquestionable; nevertheless, we very seriously question it. As one of the members pointed out in the discussion, on this basis of determining efficiency the most efficient system of illumination would be with parabolic reflectors distributed as thickly as possible over the ceiling, each giving an approximately parallel beam of light; but such light would be almost useless in illuminating vertical surfaces, and proportionately so as the angle increased from the horizontal.

HORIZONTAL ILLUMINATION AN INADE-QUATE MEASURE OF ILLUMINAT-ING EFFICIENCY

This brings out a point that is of much more far-reaching importance than its ap-

plication to this particular series of experiments. It has become customary, as shown by its being used in this case without question, to take the horizontal intensity on the theoretical "working plane," assumed to be 30 in. from the floor, as a final and complete test of illuminating efficiency of a lighting system. method is entirely empirical, and more wrong than right. The cases are comparatively rare in which careful or exact vision is required on a horizontal surface. Reading is almost never done with the page horizontal, and there are few cases of fine work in which the field of vision is a horizontal plane. It is a question whether intensity on a vertical plane at this height does not come nearer determining the usefulness of illumination. It is evident that intensity in no one single plane affords a complete expression of illuminating efficiency.

The fact noted by the authors that the color of walls and ceiling has far less effect upon illuminating efficiency than commonly supposed is easily explained, in view of their method of determining such efficiency. A focusing prismatic reflector gives the highest efficiency, according to their results, and this, of course, allows a minimum of light to reach the walls and ceiling, and also gives a minimum of intensity on the vertical plane. Had opaque parabolic reflectors been used the results would have been still more pronounced in this respect, and the conclusions still more

erroneous.

ciency would be theoretically determined by measuring the light flux received upon a hemisphere having its plane surface in a horizontal plane at the customary height; and at first glance there seems no reason why such a measurement might not be practically made. This would take into account the light received from all directions above the working plane. Such a method would give very different results from those obtained by the authors, and we believe would be much nearer expressing the actual value of illumination for the regular purposes of vision. The effect of the color of walls and ceilings would show in such a measurement as it does in

practice, and it is not impossible that this

method of measurement would nearly or

The true measure of illuminating effi-

quite reverse the order of efficiency of the various types of reflectors tested.

CONDITIONS DETERMINING VISUAL EFFICIENCY

On this subject the authors present an hypothesis which they attempt to establish by citing some well-known facts. We quote their presentation of this subject in full:

Careful observation of the conditions attending close visual work calls attention to the fact that, in by far the greater proportion of such work, we see by degree of contrast rather than by sharpness of detail. In other words, in decidedly the major portion of close visual work, the eye is seldom required to observe small objects or fine detail lying close to the limit of sensitivity of the organ. The reading of printed characters, for instance, could be accomplished almost or quite as easily if only the heavier portions of the letters were printed and all hair-lines omitted.

Or, to give a second example, if the background contrasts are reduced by employing a closely spaced, heavily blackfaced letter, the ease of reading is appreciably decreased, even though the line width employed in forming each individual letter-character has been increased. From the above it follows that the strain upon the eyes incident to close visual work under any given condition of illumination is correctly measured by the slightness of the contrast differences which the eye can perceive, rather than by the minimal size of object which the eye can perceive.

Another noteworthy consideration is that we normally read by words or phrases rather than by letters. The word or phrase is apprehended and interpreted by the brain as though it were a single character. Long experience makes the adult mind so familiar with such word-characters that only the sensation of a few broad lines, portions of the individual letters, is employed by the mind in interpreting the meaning of the character.

As this question is of fundamental importance, it is well to give any hypothesis and the substantiating proofs the most rigid scrutiny. We submit that the authors have given entirely too much importance to reading as a criterion from which to judge visual efficiency. The fact that the mind does not consider all of the detail of the printed characters in reading is a purely psychological phenomenon, and has nothing to do with the actual processes of vision. We differ radically with the statement that "we see by degree of contrast

rather than by sharpness of detail," and submit the hypothesis that visual efficiency depends upon the sharpness of the image upon the retina.

Probably the most convincing proof of this hypothesis is found in the fact that the most common, and by all means the most serious, cause of eve strain is astigmatism. The effects of eye strain produced from this cause are sufficient, as has been abundantly shown, to produce not only the most intense suffering of the eyes themselves but to cause nervous and physical disorders, ranging all the way from persistent headache to epilepsy and insanity. Astigmatism is simply an irregularity in the shape of the lens of the eve which renders it impossible for it to produce a sharp image upon the retina. The lens, instead of having its normal spherical curvature, takes a more or less elliptical, or egg-shaped, curvature, so that if lines in one direction are focused sharply those at a certain angle, generally more or less nearly perpendicular to these, are out of focus. The strain due to far-sightedness, a condition which always comes at some period after middle age, in attempting to read at the usual distance at which the eve no longer produces a sharp focus, is also sufficiently familiar.

Referring to print, upon which the authors lay stress, the reader has probably at some time observed the difficulty of reading a section of a newspaper which happened to slide slightly while in contact with the type, thus blurring all the outlines of the letters. It is true that there are comparatively few cases in which the eye is regularly called upon to distinguish very small objects, but, on the other hand, there are no cases requiring careful vision in which the eye is not required to distinguish outlines sharply, and according as the image upon the retina produces these outlines, sharply or vaguely, is the visual function performed with ease or strain.

THE EYE SHOULD BE TESTED UNDER NORMAL CONDITIONS

The tests on visual efficiency were carried out on the assumption of the truth of the hypothesis proposed by the writers that vision is the act of distinguishing contrasts, or difference in intensity of illumi-

nation. The method of procedure was carefully worked out to comply with this condition, and is thus described in the paper:

With the eye in the dark, the test object is illuminated to the intensity required to produce just-visibility. This intensity is measured. Then, with the eye exposed to the illumination conditions which are being investigated, the object is again illuminated to the just-visibility point. The intensity of this illumination is measured. By dividing the intensity of illumination required on the test object by the eye in the dark by that required under the illumination conditions which are being investigated, a value is obtained which it is believed may correctly be taken as representing the efficiency of the eye. The test object consists of a solid black circle flanked on either side by a solid black square of equal area, or of a square flanked on either side by a circle. The subject is required to tell whether the central of the three objects is a circle or square. This involves upon the subject the necessity of being able to clearly see the contrast between the object and the background.

The assumption of facts by the authors reminds us of an old anecdote of Sir Isaac Newton, who was reputed to be absent-minded when occupied in his scientific ruminations. It was said that on one occasion he took his wife's finger to poke down the tobacco in his pipe, an incident which was undoubtedly proof of the point at issue-viz., his absorption in his own thoughts—but which lost much of its force when one stopped to consider that the great scientist was never married and never smoked. Dr. Louis Bell pointed out in his excellent paper on "Photometry of Low Intensities," at the Chicago convention, that the eve acquires a remarkable facility for seeing in the dark after having been subject to such a condition for a period of a half hour or more, and this very unusual condition is what the authors take as 100 per cent, visual efficiency. But what has ability to see in the dark got to do with the ordinary problem of illumination? The practical question is not how well we can see by dim illumination, but what intensity of illumination and under what conditions of its production can the eye work continuously with least fatigue. Like the proof of Newton's mental aberration, the conclusions reached by the authors would be more convincing if the assumed facts upon which they were

based were proven; but we cannot accept offhand either the statement that vision depends fundamentally upon contrast or that ability to see in the dark is a practical test of the efficiency of the eye.

Even if both of these statements were true, the method of tests pursued did not take into consideration the time element; in other words, they simply tested the ability of the eye to see under certain conditions, without determining the result of continued effort under these conditions. This alone would strip the results of nearly all of their practical value. Visual efficiency involves the time element. Visual efficiency, so far as it has a commercial or practical significance, depends upon the ability of the eye to perform its work through the usual period of employment, which may be the working day in the industries or the regular hours of study, or other work requiring its use. Tests which do not involve the time element in the use of the eve are of very little importance. As to the value of their measurements, the authors say:

The method of measuring in terms of relative illuminations required expresses visual efficiency directly in terms of the characteristic in which we are most interested. This is as true from the standpoint of pure commercialism as it is from the standpoint of health and of avoiding undue eye strain. If a given system requires 10 per cent. higher illumination on the object than some other system for equally adequate vision, it means that the energy consumption cost is increased 10 per cent.

Visual efficiency is a purely physiological function, and to express it mathematically we should have to have a method of measuring numerically the amount of muscular and nervous energy required in the performance, a thing which science has not vet been able to accomplish. If it can be proven that the muscular and nervous energy required for vision has a definite mathematical relation to some measurable condition of illumination, then we have the means for expressing visual efficiency as a mathematical quantity. The authors assume that they have discovered such a relation, but they are very far from having proved it. It seems very plausible that the lesser the quantity of light which the eye is compelled to receive in order to perform its work, the less energy will be required; but to assume a mathematical relation between these two is far beyond the limits of scientific deduction. To say that because the eye can instantly distinguish between two objects, empirically chosen, by half the illumination under one condition that is required under some other condition, that therefore the visual efficiency of the former is twice that of the latter, is simply an unwarranted jumping at conclusions.

We may repeat here that our criticisms are not of the authors, but of the methods and conclusions of certain scientific experiments. Whether these particular methods and conclusions were right or wrong is of minor importance; the main question is, What are the lines along which investigation and experiment will lead to results of practical value? One means of arriving at such methods is a criticism of methods suggested or employed, just as the way to perfect a mechanical device is to make it after some pattern, and then find out its weak or inconsistent elements, or, in common phrase, to find out the "bugs" that they may be eliminated.

Basis of Measuring Visual Efficiency

We believe the following propositions to be substantially self-evident: First, no method of determining visual efficiency is of any practical account that does not involve a continuous use of the eye for the ordinary period which it would be used under the given conditions, and, second, the conditions must be such as normally occur or for which the eye is regularly adapted. In other words, vision must take place under the ordinary degree of illumination and under the conditions which are met in regular use.

We should, therefore, be inclined to place much more value upon the opinion of a number of operatives who had worked under different systems of illumination for considerable periods of time, as to their relative visual efficiencies, than upon any scheme of experiments involving the most accurate measurements and precautions that recorded only momentary effects, or were made under usual conditions. A particularly striking example of the erroneous conclusions that may be derived from a failure to observe these common-sense conditions is the case of glare produced by a strong light in the field of vision. As was shown by one of the authors in a previous paper, and can be very easily verified, a strong light at certain angles in the field of vision actually increased visual acuity momentarily. From this we might jump to the conclusion that glare under such conditions is a good thing, that it increases visual efficiency; but it would take but a few minutes' continuous subjection of the eye to these conditions to show the absolute fallacy of such a conclusion, for fatigue, amounting soon to a serious strain. follows the use of the eve under such a condition.

Illumination and vision is an exceedingly complicated subject, as we have often been told, involving physics, physiology and psychology, and we want to be mighty sure that we are not assuming what is unproven, or jumping at conclusions, when we undertake to experiment with these exceedingly recondite subjects. A thing is not necessarily true because it is plausible, especially in the little understood fields of physiology and psychology. Let us by all means continue research, but let the conclusions be drawn with a very careful regard for the principles of inductive science.

SOCIETIES

THE ILLUMINATING ENGINEERING SOCIETY

At the February meeting of the New York Section a paper was presented by Messrs. A. J. Sweet and L. C. Doane, entitled "The Choice of Reflector: Its Influence Upon Illumination Efficiency and Depression of Visual Function." A general review of this paper appears in another section of this issue. Although the reading of the paper occupied the usual time

of a meeting, there was an animated discussion of the various points brought out, which was largely in the nature of objec-

tion and criticism.

The Philadelphia Section held its February meeting on the evening of the 16th, beginning with the usual dinner at Mosebach's restaurant. The meeting was opened with the second lesson in the educational course which is being given by Prof. A. J. Rowland, of the Drexel Institute. The subject this time was "Candle-power," which he explained in its various meanings, in his own peculiarly clear and simple manner, demonstrating his explanations with simple experiments. The paper of the evening was on the "Physics of Light," and was delivered by Prof. George A. Hoadley, of Swarthmore College. The paper was illustrated by demonstrations and lantern slides and was received with the closest attention on the part of those in attendance.

A new section of the society has been formed in Pittsburgh, the final organization of which took place at a meeting held at the Fort Pitt Hotel on the evening of February 13, following a dinner

at which Prof. H. S. Hower, of the Carnegie Institute, acted as toastmaster. Addresses were made by Mr. V. R. Lansingh, president of the society; Mr. P. S. Millar, general secretary; Mr. G. H. Stickney, chairman of the New York section; Mr. Norman Macbeth, vice-president of the society; Mr. T. M. Trimbell, chairman of the Pittsburgh section of the American Institute of Architects; Mr. B. R. Shover, president of the Association of Iron and Steel Electrical Engineers; Mr. J. S. Orr, general superintendent of the Allegheny County Light Company; Mr. M. W. Donkin, and Mr. T. R. Cook, of the Pennsylvania Railroad.

The meeting was largely attended and gave an enthusiastic reception to the several speakers.

The following officers were elected for the section: Chairman, H. S. Hower; secretary, C. J. Mundo; managers, W. Edgar Reed, C. E. Clewell, S. B. Stewart, E. R. Roberts, and W. M. Skiff.

The section already has a membership of nearly one hundred and will be the meeting point for members in western Pennsylvania and Ohio.

CURRENT LITERATURE

New Books

OUTLINES OF APPLIED OPTICS, by P. G. Nutting. 234 pp. Illustrated with diagrams. Cloth. P. Blakiston's Son & Co., Philadelphia. Price, \$2, net.

The author of this book is associate physicist of the Bureau of Standards, Washington, and the high character of both his work and his writing is familiar to the illuminating engineering fraternity through the many excellent contributions in the bulletins of the bureau. The preface to his book contains suggestions of so much value, entirely apart from the book itself, that we give it in full:

These outlines of applied optics deal with optical instruments and optical measurements from the standpoint of sensibility and precision. The first three chapters treat of instruments for forming images; the remaining chapters, special instruments for analyzing light and determining the proper-

ties of materials. The keynote throughout is the question of securing the best possible results in optical work. It might be well classed as optical engineering or technical optics, but applied optics is a broader term.

Applied optics is practically untaught in any university. By the student of pure optics, optical instruments are regarded as mere tools to be simplified and ignored rather than studied. The physical properties of the eye and photographic plate, essential parts of every optical instrument, are largely unknown and disregarded. Color and colorimetry rest practically where Maxwell's great contributions left them. Light itself is not even precisely defined.

No class of engineering offers higher prizes than the different branches of optical engineering—lens design, illuminating engineering, colorimetry, photography, radiometry, pyrometry, etc. No richer field awaits the investigator versed in pure optics than those of applied optics, and a student can find no more alluring, promising or brain-racking problems than are to be found in these neglected fields. There are ample reasons why applied optics should be taught as such in at least a few of our leading uni-

versities, and it is hoped that this work may add strength and unity to such tendencies.

But the book has been prepared for the worker in applied optics rather than the stu-dent; for the men in the field designing instruments, measuring color, examining eyes, identifying illuminants, etc., who may find a suggestion of how to obtain better results or ready information on nearly related sub-

jects.

A full treatment of applied optics of the scope here chosen could be adequately treated only in a number of volumes by a dozen specialists, but as the time is not yet ripe for so extended a treatise, it was thought best to prepare a briefer work of the same scope to serve as an entering wedge. More than all else, it is hoped that this book will stimulate work in the many almost unworked fields within its borders, so that when the time is ripe the material for a more pretentious treatise may be available.

We need add hardly more than to say that the author has accomplished his purpose as above set forth with consummate judgment, as well as ability. higher mathematics are used to a considerable extent, the explanations are so clear that those unable to follow the mathematical demonstration will, nevertheless, be able to obtain as complete an understanding of the subject as is possible without mathematical knowledge. If the practising illuminating engineer or the student of the subject is to select a book on optics we should unhesitatingly say "put Dr. Nutting's work at the head of the list.' It forms another solid foundation stone in the basis of scientific illuminating engineering.

American Items

STREET LIGHTING AT ENID, OKLA.; Electrical

World, February 3.

A WHITE WAY INSTALLED UNDER DIFFICULTIES: Electrical World, February 10. DECORATIVE LIGHTING IN FARGO, N. D.; Elec-

trical World, February 10.

MAINTENANCE OF LIGHTING EQUIPMENT, by Ward Harrison; Electrical World, February - 10.

GRAPHS OF CERTAIN RELATIONS IN INDUSTRIAL LIGHTING ECONOMICS, by Roscoe Scott: Electrical World, February 10.

COLOR CONTRASTS IN ILLUMINATION, by Bas-

sett Jones, Jr.; Electrical World, February 17.

TUNGSTEN STREET LIGHTING IN JOLIET, ILL.; Electrical World, February 24. TUNGSTEN LAMP PATENT; Electrical World,

March 2.

AN EFFECTIVE ILLUMINATION SCHEME IN HOLY TRINITY CHURCH, NEW YORK; Electrical World, March 2.

ELECTRICITY VS. WAX IN RELIGIOUS WORSHIP, by Roscoe Scott; Electrical Review and

Western Electrician, February 3.
Chronology of Illumination, by W. R.
Morgan; Journal of Electricity, Power

and Gas, January 20.

Decorative Lighting in San Francisco; Journal of Electricity, Power and Gas. February 17.

THE HOUSE OF EDISON LIGHT; Selling Elec-

tricity, February.

THE MOST MODERN STREET LIGHTING; Selling Electricity, February.

Principles of Illuminating Engineering, by A. G. Rakestraw; Southern Electrician, February. Machine Tool Illumination, by C. E. Cle-

well; Electric Journal, February.

Some Observations on the Metallic Arc, by G. M. Little; Electric Journal, February.

SIGNIFICANCE OF ORIGINALITY IN MODERN GAS LIGHTING, by F. L. Godinez, Chapters 4 and 5; Progressive Age, February 15 and March 1.

LIGHTING WINDOW DISPLAYS WITH GAS, by Samuel Snyder; Progressive Age, March

A Successful Church Installation, by James W. Brown; Progressive Age, March I.

DETAILS OF A RESIDENCE LIGHTING CAM-PAIGN CONDUCTED BY THE PUBLIC SERVICE GAS COMPANY; American Gas Light Journal, February 12.

INDIRECT ILLUMINATION; Gas Industry, Feb-

GAS FOR STREET LIGHTING; Gas Industry, February. GOOD READING LIGHTS AND BAD ONES: Acety-

lene Journal, February.

ELECTRIC STREET LIGHTING; Municipal Journal and Engineer, February 29.

EDITORIALS

Electrical World:

DETERMINATION OF LUMINOUS EFFICIENcy, February 3.

Progress in Illuminating Engineer-

ING, February 10.
Electrical Review and Western Electrician: Prodigality in Electric Lighting, February 10.

Journal of Electricity, Power and Gas: CHRONOLOGY OF ILLUMINATION, January

Foreign Items

COMPILED BY J. S. DOW

ILLUMINATION AND PHOTOMETRY

NEW PHOTOMETRIC APPARATUS, by J. S. Dow and V. H. Mackinney (Illum. Eng., London, January, 1912).

Describes the new model of the "Holo-phane Lumeter," Illumination Photometer, and some new accessories for use therewith in measuring daylight, etc. Another new

piece of apparatus enables polar curves of light distribution to be determined by a very simple and convenient method. No mirrors are necessary; the standard white surface is merely rotated round the source and its brightness (Prop. to the candle-power in that direction) studied at each angle.

THE DESIGN OF MOTOR CAR HEADLIGHTS, by Dr. H. B. Hickman (Paper read at the Illuminating Engineering Society in London; Illum. Eng., London, December,

1911).

A paper describing a large number of types of motor car headlights and accompanied by diagrams showing how the beams should be arranged to avoid dazzling drivers and pedestrians, and yet to illuminate the road brightly and evenly.

HYGIENIC ASPECTS OF ILLUMINATION, by Dr. A. Moeller (Illum. Eng., London, Jan-

vary-February, 1912).

An article summarizing progress at recent congresses and by government authorities in different countries in favor of good illumination. France has already appointed a government committee on the subject, and Belgium, it is hoped, will shortly follow suit. Reference is also made to an important forthcoming congress on the Prevention of Industrial Accidents, in Milan.

STUDIES IN LIGHT PRODUCTION, by R. A. Houstoun (Electrician, October 27, November 10, December 1, 15).

A serial article summarizing recent progress in this section.

ILLUMINATION AS A STUDY FOR ARCHITECTS, by J. Darch (Paper read before Society of Architects, London; J. G. L., January

16; G. W., January 13, 1912).

General paper. Lays great stress on avoidance of glare and of cumbersome chandeliers, etc., and suggests some simple methods of using shades to screen the lights. Points out the great opportunity before the architect into whose hands the control of the lighting of many buildings naturally falls. SOME ASPECTS OF RAILWAY STATION AND

GOODS YARDS ILLUMINATION, by Haydn T. Harrison (Paper read before the Illumi-

nating Engineering Society, London; Illum. Eng., London, January, 1912).
Contains some general remarks on the importance of good illumination to railway companies and useful tables indicating candle-power requisite for various conditions. It is also attempted to group stations in different classes and to state the corresponding illumination required. Thus the minimum illumination for a main line terminus varies from 0.2 to over I foot-candle, and in the "tubes" a value near 0.25 is usually obtained. A suggested minimum of 0.2 for important stations is therefore proposed. Other sections of the paper emphasize the importance of small units spaced at frequent intervals to secure uniform illumination. In the discussion an interesting item takes the form of a series of data on illumination

and photographs of the underground railways in London.

COLOR DISCRIMINATION BY ARTIFICIAL LIGHT, by T. E. Ritchie (Paper read before the Illuminating Engineering Society, London, Illum. Eng., London, February,

1912).

This paper attempts an interesting comparison between the effect of various illuminants on colors. The matter is tested by the study of a series of colored ribbons in several ways—(1) by noting visual effect, (2) by analysis of color with the Tintometer color-matching apparatus, (3) by measurements of reflecting power of materials, (4) by special photographs taken with plates and filters—making the sensitiveness almost identical with the eye, the photos by various artificial illuminants of a series of colored ribbons being compared with those by diffused daylight. These researches are quoted to establish the close resemblance of inverted arc lighting to daylight. The important applications of this color question to many branches of work, florists, dyers, artists, drapers, etc., are also pointed out. In the discussion one of the most interesting features was the exhibition of a new "daylight unit," composed of a tungsten lamp equipped with a special Wratten screen, converting its light into a close approximation to daylight. This is the invention of Dr. Kenneth Mees. LECTURES ON ILLUMINATING ENGINEERING

(See *Illum. Eng.*, London, December, 1911; January and February, 1912; *J. G. L.*, January 16, 23, 30; February 6, 13,

20).

Three courses of lectures on illuminating engineering are taking place simultaneously in London, at University College, Regent St. Polytechnic and at the Northampton Institute. These are briefly reported in the Illuminating Engineer (London). There is also a special series of abstracts of the last six lectures at the Regent St. Polytechnic (by Mr. J. S. Dow) in the *Journal of Gas*lighting.

ELECTRIC LIGHTING

THE PROGRESS OF ELECTRIC LIGHTING, by M. Solomon (Science Progress, July, 1911).

A very complete and readable account of recent progress.

DIE DREIPHASEN-MOOREANLAGEN IM ELEK-TROTECHNISCHEN INSTITUT DER K. K. TECHNISCHE HOCHSCHULE, BRESLAU, by G. Hilpert (E. T. Z., November 2, 1912). An interesting account of the Moore lighting installation at the Technical College at

Breslau. A rather peculiar looped arrangement of the tube is used with a view to securing uniform illumination. The illumination (max. 176 lux, min. 72 lux) is exceptionally high for a lecture theater. The diversity coefficient is given as 2.45 and the specific consumption as 0.44 watts per lux per square meter of floor area.

A Device for Using Glow Lamps on a Low Frequency (Rev. Electrique, October 27, 1911).

An ingenious arrangement of two lamps, one having an inductive resistance in series, the other a condenser, so as to produce a difference of phase of 90 degrees and cause the fluctuations in light to neutralize each other. One may also utilize two distinct filaments in the same bulb in this way.

Eclairage à Arc sur Haute Tension (Rev. Electrique, October 13).

Account of an installation of "Conta" automatic arc lamps in series on 6,300 volts; the installation was made on the occasion of the recent Turin exhibition.

DIE WAHL DES REFLEKTORS UND DER AUF-HANGHÖHE FÜR DIE STRASSENBELEUCH-TUNG MIT METALLFADENLAMPEN, by L. Bloch (*Elek. u. Masch.*, December 3, 1911).

Dr. Bloch points out that the natural curve of polar distribution of light from metallic filament lamps is not suited to street lighting, and some form of reflector is necessary. He describes experiments with three forms, respectively conical, parabolic and spherical, and points out their advantages by aid of curves of illumination and tables. Eventually he endeavors to establish a formula for lighting of this description, giving the desirable distance apart for lamps of a certain candle-power at a specified height.

A Novel Country House Installation, by F. H. Davies (*Elec. Rev.*, December 1).

Suspension pour Lampes Electriques, by A. Giron (*Electricien*, November 25, 1911).

Condensers and Metal Filament Lamps (Electrician, December 8, 1911).

ELECTRIC STREET LIGHTING, by H. F. J. Thompson (*Elec. Rev.*, January 5, 1912).

GAS, OIL, ACETYLENE LIGHTING, ETC.

REMARKS ON THE OUTSIDE DEPARTMENT, by R. Halkett (J. G. L., October 14, 1911). GAS UND HYGIENE, by E. Othmer (J. f. G.,

November 4).

Vereinfachte Methoden zur Prüfung von Glühkörpern, by Benke (Z. f. B., December 20).

A COMPARISON OF HIGH PRESSURE GAS AND FLAME ARC LAMPS, by W. Bertelsmann (J. G. L., November 28).

Public Lighting, by Garsed (J. G. L., December 19).

Some Aspects of Lighting (J. G. L., November 21, 28; January 16, 1912).

An interesting and lengthy discussion between the Journal of Gaslighting and the engineering correspondent of the Daily Telegraph on a number of points in the debatable ground between gas and electricity. Whatever view one takes of the conclusions drawn, the collection of information is interesting and will doubtless be of value for future reference.

Comparative Costs of High Pressure Gas and Flame Arc Lamps (J. G. L., No-

vember 28).

L'EMPLOI DE L'ACETYLENE DANS LES SERVICES SANITAIRES DES AVANT POSTES (Rev. des Eclairages, December 15).

Ueber Luftgas und einen Neueren Apparat zu seiner Erzeugung (Z. f. B., Decem-

ber 10).

A RETROSPECT OF GASLIGHTING DURING 1911 (J. G. L., December 26, 1911).

Contractions used:
E. T. Z. Elektrotechnische Zeitschrift (Berlin).
Elek. u. Masch. Elektrotechnik und Maschinenbau (Vienna).

G. W. Gas World (London). Illum. Eng. Lond. Illuminating Engineer of London.

J. f. G. Journal für Gasbeleuchtung (Berlin). J. G. L. Journal of Gaslighting (London). Z. f. B. Zeitschrift für Beleuchtungswesen (Berlin).



IN THE PATH OF PROGRESS

A Chart That Specifies Reflectors

The Holophane Company, Newark, Ohio, has just published as a wall hanger a spacing chart that tells at a glance just which Holophane reflector should be used for the equipment of lights of any given height and spacing in order to secure the most efficient and appropriate illumination. The principle of the chart is shown clearly in the reproduction herewith.

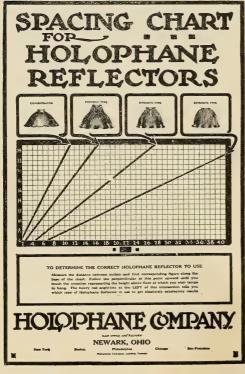
To determine the correct reflector to use under any conditions it is only necessary to measure the distance between outlets and find the corresponding figure along the base of the chart. Then follow the perpendicular line at this point until you touch the cross line representing the height above the floor at which you

wish the lamps to hang. Then the heavy angle line first encountered to the left of this intersection points out for you which type of reflector to use to obtain absolutely satisfactory results.

New Publications

The Adams-Bagnall Electric Company, Cleveland, Ohio, have issued a looseleaf data book giving complete descriptions and specifications of the lighting specialties which they manufacture. The illuminating engineering data sheets are especially commendable. Each sheet gives the distribution curve of a lighting unit, with the numerical values of the candlepower of different angles in tabular form, the complete specifications of the lamp used, the ratio of the mean spherical candle-power of the lamp to that of the lamp with reflector, the ratio of the lower mean hemispherical candle-power of lamp to that of lamp with reflector, and the relation of the correct mounting height to the distance between units with allowable variation. This gives the engineer all the data which he needs to use for ordinary purposes, and in the most direct form.

The W. B. Brown Company, Bluffton, Ind., have issued an exceedingly handsome catalogue of their wood and artglass lighting fixtures. In the physical make-up of this catalogue its publishers have departed as widely from traditional forms as they have in the material and construction of the fixtures which it illustrates. Instead of the ponderous and unwieldy album opening at the end, it is the shape of an ordinary book a trifle smaller than the standard magazine, and is handsomely bound in brown muslin with a decorated cover. Each page illustrates and describes a single lighting fixture, and is embellished with an appropriate and artistic border. A number of interiors showing the lighting fixtures in actual use



THE NEW HOLOPHANE SPACING CHART.

are illustrated, two of them in color. The book contains 534 pages, and is altogether the most pleasing catalogue of lighting fixtures that has come to our attention.

"Street Railway Lamps" is the title of Bulletin 18, recently issued by the Engineering Department of the National Electric Lamp Association, Cleveland, O. This bulletin gives complete data on gem and carbon lamps for street railway use, and should be of considerable interest to those connected in any way with street

railway work.

Bulletin 19 has also been issued illustrating and describing the electric luminous radiator, and calling attention to the many ways in which it may be made a convenience in the home. The non-luminous type of radiator is mentioned and comparisons are drawn between the two kinds. A table of data on luminous radiator lamps in regard to size, wattage, voltage, etc., is inserted. Copies of these bulletins may be obtained from the engineering department upon request.

H. W. Johns-Manville Company Becomes Selling Agent for I. P. Frink, Inc., New York

The business done under the firm name of I. P. Frink is an excellent example of what can be accomplished by undivided attention to a special line of manufacture combined with progressive ideas and sound and conscientious business ethics. There are probably few even in the lighting field that know the proportions to which this company has grown, the gross annual sales of which are double that of many manufacturers that handle larger lines, and are more heard of by the public in general. Broadly speaking, the Frink Company are manufacturers of every kind of lighting accessory in which silvered glass can form a part. In this field they have been masters for fifty years, and the installations of their wares include everything from a reflector designed for use with gas flames to the most complicated illuminating engineering problems in the lighting of some of the largest and finest modern structures in this country.

The H. W. Johns-Manville Company

has already become a recognized factor in the illuminating field through their successful introduction of the Linolite lamp, the sale of which has increased in an unprecedented manner. Their large and splendidly organized selling organization, together with their acquaintance in the electrical trade, should afford a splendid opportunity for the still further development of the combined business. Both concerns have made systematic use of illuminating engineering of the highest order, and, we understand, will extend this service throughout all of their selling agencies in the United States and Canada. This combination means much more than a simple business arrangement between two successful companies; it means another powerful factor in the promotion of more and better light. As in all good business moves, the public will benefit as well as the company.

While speaking of the H. W. Johns-Manville Company it will interest their many friends and customers to know that the annual convention of their department managers and salesmen took place in their new building, at Madison avenue and Forty-first street, during the week of February 5, at which there were over one hundred representatives present. several meetings and factory inspections were highly enjoyed and appreciated by all, and when the convention closed with the banquet on Saturday evening, all declared that it was one of the most profitable and enjoyable affairs that it had ever been their good fortune to attend.

"Gas Meeters" Meet and Dine

The "Gas Meeters" is a combination social and business club composed of men connected with the gas companies in New York and Brooklyn, and having for its object the mutual advancement of its members in their respective lines of work. Their sixth meeting was held on February 26, at the Industrial Gas Appliance Laboratory of the Consolidated Gas Company, Twenty-second street, and Second avenue, New York, where the members assembled at 4 p.m., and were given a demonstration of the various devices on exhibition. At 6 o'clock they repaired to Sheffel Hall, where they indulged in a

genuine German dinner. Informal speeches were made by Mr. Louis Stotz, Secretary of the National Commercial Gas Association; Mr. M. H. Spear, manager of the New York & Queens Gas Company; Mr. S. K. Campbell, manager of the Nassau & Suffolk Lighting Company; Mr. S. Tully Wilson, Mr. J. M. Brock, Mr. A. M. Berg, and others.

Announcements

Messrs. Walter G. Warren and B. C. Garrison announce the change in the corporate name of Tietgen, Falk & Co., to Walter G. Warren & Co. This change in the corporate title of the fixture business that has become well known in the trade under the old title is to secure a name which more definitely represents the present personnel of the company, of which Mr. Warren is president, and Mr. Garrison secretary and treasurer. The factory and display rooms remain at the same address, 550-552 West Van Buren street, Chicago.

The Electric Construction Company, of St. Paul, Minn., are sending out a public announcement stating that in response to the general demand for scientific illumination they have established a department of illuminating engineering under the direction of Mr. Arthur L. Abbott, as illuminating engineer, with Mr. Clovis M. Converse as assistant engineer. The new department is completely equipped for the successful handling of all illumination problems, and will fully maintain the reputation of the company for services and efficiency.

The Pittsburgh branch of the H. W. Johns-Manville Company have moved from their present location on Liberty avenue, above Ninth street, to the new eight-story stone, reinforced concrete and steel building at the northeast corner of Wood street and First avenue, which has been leased by them for a term of years.

Mr. Severn D. Sprong has resigned his position as chief electrical engineer of J. G. White & Co., Incorporated, New York, and accepted that of electrical engineer of

the Brooklyn Edison Company, retaining the relation of consulting electrical engineer to J. G. White & Co.

The annual meeting and convention of the New England Section, National Electric Light Association, will be held at Hotel Kimball, Springfield, Mass., March 14 and 15.

What is "Light Furniture"?

That lighting fixtures, at least under certain conditions, are to be considered parts of the furniture rather than of the building seems to be generally accepted; in fact, it has been so far recognized that a concern in Rockford, Ill., is manufacturing a line of lamps, domes and general fixtures constructed of wood and art glass, to which they give the name "light furniture." The lighting devices, which they show in a very neat little catalogue, are as novel in conception and workmanship as the name given to them by their makers. The introduction to their catalogue, which has the title "Mahogany and Oak Lamps," is sufficiently interesting to reprint in full:

We have endeavored to present in the following pages a very new departure in the application of wood in the construction of illuminating devices. The possibilities in this line have been limited heretofore, owing to inability to design fixtures in other than Mission or straight line effects, but we, by applying knowledge gained through years' experience in manufacture of furniture, have succeeded in perfecting a practical, durable and strong method of constructing shades with bent ribs of wood, enabling us to furnish any style of curved domes possible in metal.

The art styles, shown herein, are designed on classical lines and the figures and busts are carved from solid wood, making pieces that have true value and merit beyond the usual cast and plated bases. To the critic and true lover of the beautiful, these lamps are very appealing. The effect produced by harmonizing the design and finish of furniture and trim of a home with the illuminating devices is novel, producing an interior that is soft, rich, and pleasing.

The concern is known as the Rockford Light Furniture Company.

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STANDARD DOUBLE SUPERHEATER LOWE WATER-GAS APPARATUS

Tar Extractors for Carburetted Water Gas.

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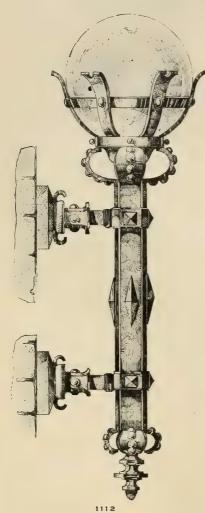
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Another one of our Thousand and One Varieties



Brackets for Electric or Gas, made in Wrought or Cast Iron, Brass or Bronze, together with the other thousand appliances for artificial light, such as Domes, Chandeliers, Portables, etc., too numerous to mention.

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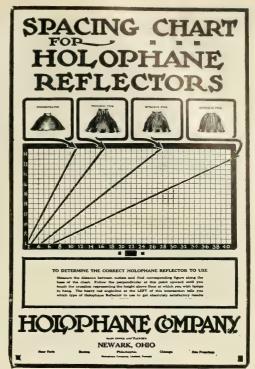


London

A HOLOPHANE SPACING CHART

Another Clever Aid to the Illuminating Engineer

The Holophane Company has just published a Spacing Chart, an ingenious device to assist the illuminating engineer in specifying proper Holophane Reflectors. It is a ready-reference wall hanger,



that tells at a glance just which Holophane Reflector to use in any given location. It is simple and "it works," a handy short cut enabling the engineer to determine instantly the proper reflector to use and how high to hang it—and be sure he's right without stopping to calculate. By referring to the chart he sees instantly just how far apart a given type of reflector should be spaced at a given height. It's a simple process of putting your finger on the chart and following out the line. There is nothing complicated or involved about it.

We believe that this Holophane Spacing Chart will prove a real convenience to the illuminating engineer, and we will be glad to furnish them on request without charge. The chart is printed in good taste and will not disfigure your office. Hang it on the wall where it is within sight.

HOLOPHANE COMPANY

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Catalogue 17 is actually the most convenient and comprehensive display of lighting fixtures ever assembled. If you want the right fixture for your particular requirements, investigate this as the true index of Williamson Service—"Extends Everywhere."

Catalogue No. 17 will be sent free, express prepaid, to any lighting company or fixture dealer in the country not already possessing it.

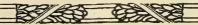
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I. P. Frink will manufacture for us the well-known J-M Linolite System of Illumination.

An Engineering Department will be maintained along extensive lines, and estimates and data will be promptly submitted on receipt of plans and detailed information.

This arrangement enables us to successfully handle any problem in Illumination.

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H. W. JOHNS-MANVILLE CO.

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PARIAN GLASS, a beautiful marble-white, translucent creation, is produced in the latest architectural forms for 20th Century illumination, comprising

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for preventing lamps from working loose from jar or vibration.

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This device has already been adapted for our entire line of Reflector Sockets and Industrial Lighting Fixtures.

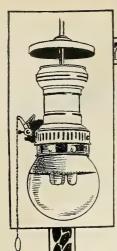
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The Gas Arc has made a permanent and important place for itself in the field of artificial lighting. It has [demonstrated its superiority in



View of John B. Daniel's Sons & Sons Department Store, Broadway, New York, using 65-3 and 5 mantle Humphrey Inverted Gas arcs

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both the *quality* and *economy* of illumination produced for commercial and industrial purposes. It has the facts and figures to back up its claims.

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"Gas Arc" and "Humphrey" are synonymous terms: the one invariably suggests the other. The first time the public ever saw the word "Gas Arc" they saw it immediately after the word "Humphrey."

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Wheeler Mazda Street Fixtures





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Send for descriptive bulletin which gives photometric data, prices, etc.

Send for Our New Bulletin

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In the meantime, I have a sufficient stock of

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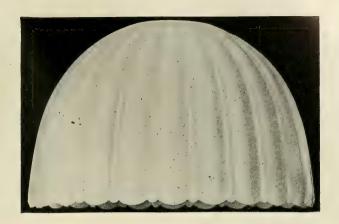
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REMEMBER—that we can design and manufacture anything of a special character in illuminating glassware—or fulfill architects' and engineers' specifications to the finest detail. We are glass manufacturers only, not fixture dealers or makers.

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INDEX FOR VOLUME VI

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GOOD LIGHTING and THE ILLUMINATING ENGINEER

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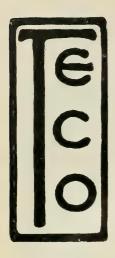
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WE make every kind of glass used in illumination. Each has its individual good qualities. But for nearly all lighting purposes, *Alba* is the best glass ever produced.

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great effectiveness, or concentrates and directs it accurately, according to the shape of the shade. Each type of shade is made for its particular purpose with scientific exactness. *Alba* is handsome and easy to keep clean.

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As makers of illuminating glassware for 35 years, we have published the following:

"Scientific Illumination" (which treats simply of the whole subject of lighting).

"General Catalogue of Lighting Glassware" (complete).

"Decorative and Efficient Interior Illumination."

"Ornamental Street Lighting."
"Alba Pendant Spheres."

"Photometric Curves of Alba Shades."

All accurately illustrated.

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"Increasing Human

One of the XIII chapters in the book entitled above (the work of Walter Dill Scott) is, The Love of the Game and Efficiency.

This one chapter alone so appealed to us in connection with the movement expressed by GOOD LIGHTING—the movement for MORE AND BETTER LIGHT—that we could not but feel that Mr. Scott's book should be in the hands of every subscriber to our publication.

For the purpose of co-operation with our subscribers and to help to "pay the freight" we will send this book—"IN-CREASING HUMAN EFFICIENCY IN BUSINESS"—to anyone who will secure for us two new subscribers.

Address Circulation Department

GOOD LIGHTING

AND THE ILLUMINATING ENGINEER

GOOD LIGHTING

AND THE ILLUMINATING ENGINEER

Vol. VII

APRIL, 1912

No. 2

Atlantic City's New Boardwalk Illumination

Happy Days and Glorious Nights

Somewhere in "Romeo and Juliet" reference has been made to the garish daylight. Far be it from us to go quite so far as Shakespeare in using such language as applied to Atlantic City; but the fact still remains that as compared to the night the daytime is even "garish." People un-

doubtedly look their best by artificial illumination, if it is all that it ought to be. And it is at night that people will dress up and look their best.

To comply with these universally recognized conditions of humanity, the enterprising citizens of Atlantic City, in



TIG. I.—BOARDWALK, ATLANTIC CITY, SHOWING IN THE BACKGROUND THE NEW ORNAMENTAL LAMP-POSTS.



FIG. 2.—NIGHT VIEW OF NEW BOARDWALK ILLUMINATION.

co-operation with the best special advice procurable on the science and art of good lighting, have installed on the Boardwalk a system which serves its purpose—of giving us a chance to join in the parade at night.

Besides all this vanity and display, the illumination of the Boardwalk is highly artistic and dignified. This applies for day or night. And, mind you, the results secured were brought about only by the most careful co-operation of all concerned. The problem was put up to L. W. Byers, general manager of the Atlantic City Electric Company, who, from years of experience, has tested out the pulse of Atlantic City as a composite affair, and has now undoubtedly succeeded in securing one of the best, if not the best, artificially lighted ways in this or any other country.

Something in the neighborhood of \$70,000 has been spent by the city and the local electric company on the present distribution system and in extensions. The new system extends over three miles.

As shown in the accompanying illustrations, two quite distinct kinds of poles are used, as a result of co-operation with the J. L. Mott Iron Works, New York. There were two problems to meet: The proper post and lighting for the shore side, and the proper lighting for the sea side of the promenade ground.

The posts along the sea side, it will be noticed, combine cluster Mazda lighting superseded by arc lighting. These are over all 23 feet, with the incandescent lamp brackets 13 feet from the walk level. After trying out practically every type of arc lamp recognized to-day, the 6.6-amp. inclosed arcs were approved as best, partly because they harmonized best with the Mazdas, and, furthermore, did not give that excessive glare which is disconcerting rather than becoming.

As shown in the night view, the sea side posts and the shore side posts are staggered. The shore side posts differ principally from the seaside posts by using 150-watt Mazdas instead of the arc lamp.



FIG. 3.—TYPE OF STANDARD ON THE LAND SIDE OF WALK.

And to secure satisfactory diffusion, elimination of glare, and all that sort of thing, Alba ball globes were adopted.

Any one who has visited Atlantic City day or night has been quite aware that many of the visitors on the Boardwalk enjoy leaning up against the rails on either side to watch the passing throng. In the thorough investigation concerning proper lighting, it was decided best that these rails be given very strong support lest the leaners-on when particularly numerous might push the rail over. So, if you will look closely for a moment at the illustrations, you will see that the lamp-posts are not only supporters of lamps, but supporters of the rails that in turn support the lookers-on.

A special system was designed for this installation for connection with the galvanized iron conduit arrangement underneath the walk by means of cast iron junction and surface boxes. The lamps are

controlled by the block system, by means of which for two or three blocks they are in connection with a single cutout, with switches underneath the walk.

Eventually, it is now the plan to connect the lights of sea side posts with festoons, and likewise the shore side posts with one another. This festooning will be of just the opposite character of the old-time scheme where incandescent lamps were strung in arches across the walk. And it goes without saying that the proposed plan to any one casting his eye into the distance will see in perspective a much neater and uniform festoon effect than previously.

So it is that Atlantic City has conceived a distinctly artistic as well as efficient illumination for its grand parade grounds. When you stop to think of it, it is on the Boardwalk where you usually chance upon friends, for with its hundreds of hotels the Atlantic City Boardwalk is



FIG. 4.—ONE OF THE STANDARDS USED ON OCEAN SIDE OF WALK.

the common stamping ground, just as the beach is the common playground. But the chances are in beach costume one

would not know his best friend.

Again, night is the time for real festivity—as the verse afore quoted, night should be "glorious." Without lighting even the Boardwalk would be but a common thoroughfare for people to get from one definite place to another. As it is. however, people seek the Boardwalk because other people seek the Boardwalk, just as you do, because it is bright and light and cheerful.

Herewith are shown daylight illustrations of the Boardwalk. Nothing personal intended, yet taken as a crowd, they do not exhibit any such particular sense of holiday enjoyment as any one can see at night under its joyful illumination. Shakespeare was surely right; it is the "garish" daylight, by comparison. The time may come when the sun may equal artificial illumination for such festivities as people go to Atlantic City and similar places for. But at present artificial light is far in the lead and bids fair to hold it.

E. L. Elliott Retires as Editor of "Good Lighting and The Illuminating Engineer"

Change is one of the prerogatives of time, as Emerson said, and it comes about that time has brought to this publication the retirement of E. Leavenworth Elliott as its editor.

Mr. Elliott was the founder of the movement expressed by this publication. Although it was as late as 1906 that its first issue appeared, our some-time editor had been for years previously a decidedly active promoter of illuminating engineering. It was almost ten years previous, in fact, that he contributed a paper at a meeting of The New York Electrical Society on certain important relations between light and the eye. Ever since he has had his heart in this work.

Mr. Elliott claimed-and with what truth everybody now knows-that insufficient attention was given lighting, whether from artistic, scientific or commercial considerations. He set about seeking means for betterment, endeavoring to arouse those who could and would become allies for the cause of good lighting. As he stated in an editorial in the first issue of this magazine: "Artificial light is one of the commodities which every civilized human being uses every day, and the degree of civilization of a nation or people is fairly indicated by the extent to which artificial lighting is used. It is a remarkable fact that, while the production of artificial light receives attention commensurate with its importance, and has several periodicals devoted exclusively to its various branches, there is not at the present time, to our knowledge, a single publication devoted to the use of artificial light, or illumination."

"Let There be More and Better Light" has been Mr. Elliott's slogan; and any one who has followed his writings throughout the past six years as editor of the publication which he established, knows well that his aim was to promote "More and Better Light" for everybody.

Mr. Elliott was possessed throughout his work as editor with a broadly human sense of his subject. A convincing, forceful and entertaining writer, he has contributed propaganda to the subject which is quite beyond measurement. speaker, too, he has had the faculty of illuminating the subject, whether treated as an art or science.

Mr. Elliott purposes to concentrate his energies as a consulting illuminating engineer among his clients, and we venture to predict—we who have been so closely and affectionately associated with him-that he will unceasingly follow along the lines of the precept which has meant so much to him "Let There be More and Better Light."

The Illumination of a Tank Shop

By V. J. Hulquist and C. J. Mundo*

The American Locomotive Company has just completed the construction of a new tank shop at its Pittsburgh works. The shop, illustrated in Figs. 1, 2, 3, 4 and 5, is 265 ft., 2 in. long by 70 ft., 4 in. wide. It has a 32-ft. clearance between the lower chord of the roof truss and the floor. Fig. 2 shows the proposed layout of punches, shears, presses, riveters, layingout tables, forges, tank construction and test bases. The shop will be used for the manufacture of steel tanks for locomotive tenders.

In the design of this building all possible wall space not in actual contact with other buildings was devoted to windows, which rise from a point about 5 ft. from the floor. The interior walls are painted a light buff, a color which has been adopted as standard by the American Locomotive Company.

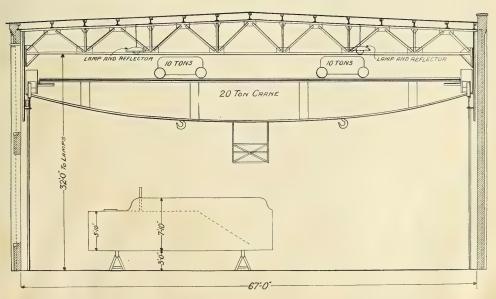
In planning the artificial illumination

of the building it was considered that the operations to be carried on in the shop—namely, laying out work for riveters, shears and punch presses, shearing and punching rivet holes in steel plates, assembling, riveting, calking and testing—required an illumination intensity within the limits which have been found satisfactory for general illumination purposes in machine shops. The installation was planned, therefore, for an average intensity of from I to I ½ foot candles.

In view of the character of the work to be done and the position of machines and of tanks on the floor during the process of construction, special consideration was given the question of freedom from shadows. A 110-volt direct current lighting circuit was available. Layouts were made for approximately equal average illumination intensity results with several "sizes" of lamps chosen from the range afforded by commercial illuminants of today. The 500-watt clear bulb tungsten

* American Locomotive Company and General Electric Company, respectively.

CROSS SECTION OF TANK SHOP.



lamp, equipped with an intensive type, porcelain enameled, steel reflector, was finally decided on as a satisfactory compromise between smaller size and more closely spaced lamps, which would hardly improve the results enough to warrant the increased first cost and operating costs, and higher candle-power lamps on greater spacing centers which estimates showed to be slightly lower in operating cost.

ILLUMINATION CALCULA-TIONS: (A) NUMBER OF LAMPS.

It was estimated that the effective lumens per watt for tungsten lamps at a height of 29 ft. from the plane to be illuminated would be approximately 3 1-3, or that the watts per square foot per foot candle would be .30. For an illumination intensity of 11/4 foot candles, .375 watts per square foot of floor area would be required. Inasmuch as the value of 11/4 foot candles is desired under average conditions, and not merely for ideal initial conditions, allowance was now made for probable depreciation in the initial illumination intensity. It was recognized that every commercial source of light depreciates in candle-power, first, due to a falling off in candle-power in the lamp itself (inherent depreciation), and, secondly, due to accumulation of dust on the lamp globe, bulb or reflector. total allowance of 20 per cent. was made for depreciation, and the wattage required per square foot of floor area was found to be $(.375 \div .80 =)$ The total watts required was then found to be (262 \times 67 \times .469 =) 8230.

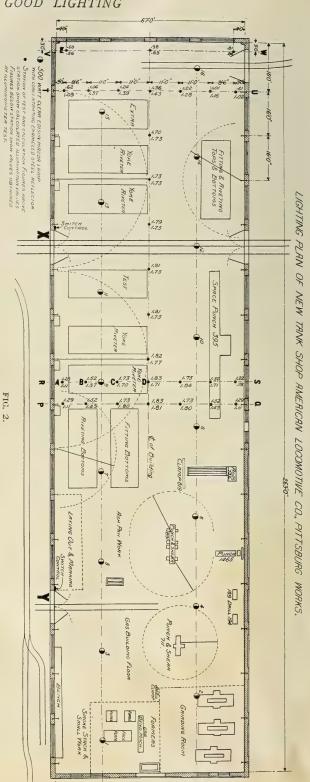




FIG. 3.-EXTERIOR OF NEW TANK SHOP OF THE AMERICAN LOCOMOTIVE WORKS, PITTSBURGH.

Sixteen 500-watt Mazda lamps were chosen, thus allowing one lamp per day as defined by the roof trusses. Lamps were staggered in two parallel rows. Each row was spaced one-guarter the width of the building from the adjacent side wall. Lamps are intended to burn at high operating efficiency. Lamps are wired in two groups, and are controlled by double pole fused knife switches near entrances A and The main lighting feeders for one section of the works pass through the tank shop. The circuits for the shop lighting are tapped on the feeder lines just inside the building. No. 6 wire is used to distribute to the two groups of lamps.

The clear bulb lamp was used since at the height of 32 ft. from the floor; the lamp filament is seen from almost any angle against the white surface of the enameled steel reflector. Shock absorbing devices were included in the suspension of the reflectors as an inexpensive insurance against the shocks and vibrations to the steel structure of the building likely to arise from the activity of the 20-ton crane with its two 10-ton trolleys and the 5000 and 1000 pound jib cranes of each, of which there are two.

(B) CHECK OF ILLUMINATION INTENSITY AND EVENNESS.

By means of horizontal illumination curves calculated (E = $\frac{CP}{H^2}$ cos^{8a}) from the candle-power distribution curve of the lamp for a height of 29 ft., assuming the plane to be illuminated to be 3 ft. from the floor, the "point by point" method was employed to find the illumination thrown by all lamps on each of the stations, as shown by the small circles in Fig. 2. The calculated values are shown above the circles. The effect of side walls is small and has not been considered in the calculations.



FIG. 4.—DAYLIGHT ILLUMINATION OF INTERIOR OF SHOP.



FIG. 5.—NEW MAZDA ILLUMINATION, ILLUSTRATION TAKEN BY THE LIGHT ITSELF.

ILLUMINATION CURVES OF NEW TANK SHOP AMERICAN LOCOMOTIVE CO. PITTSBURG WORKS

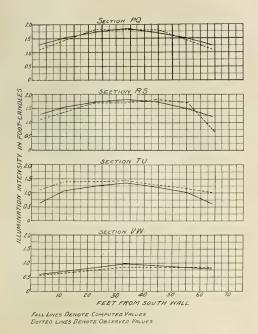


FIG. 6.

The average illumination over the central section of the building by calculation is 1.60 foot candles. The ratio of the maximum to the minimum illumination by calculation is 1.42 for the central section and 3.05 for the entire building, assuming the minimum to be at point e. This ratio, as applied to illumination intensity, is sometimes known as the diversity factor. The values indicated above are excellent, partly due to the height of the lamps and partly to the use of a large number of lamps of moderate candle-power. The average intensity (initial) for all points calculated is 1.50.

ROUGH CHECK FOR FREEDOM FROM SERIOUS SHADOWS.

It was found on examining the figures representing the intensity projected on the stations by each lamp that on points a, b, c and d, not more than 40 per cent. of the illumination was contributed by any one lamp. It was seen, therefore, that an outage in an adjacent lamp or the stopping of a crane in a position such that it cuts out an adjacent lamp would not interfere with the progress of the work.

TEST BY ILLUMINOMETER.

The figures below the station positions in Fig. 2 indicate the foot candle intensities found by means of a portable photometer at the different stations. The test values agree within reasonable limits with the calculated values. The tests were made in general at points where side wall reflection could exert little influence. The diversity factor by test on the central section proved to be 1.64 and the maximum on the central section divided by the test value at point e was found to be 3.27.

Provisions are planned to take off the smoke from the small forges on the floor, so that the shop will be free from excessive dust and soot. Realizing the importance of cleaning all types of lamps at regular intervals, it is planned to clean the lamps in the tank shop once in two weeks. As obsolescent lighting equipment in the works is replaced with the modern types of lamps, it is planned to extend this system of cleaning so that the system will become an important part of the routine of the electrical department. Lamps will be burned while bulbs and reflectors are wiped with a damp cloth.



Table Lamps from the Artistic Standpoint

By J. WOODLEY GOSLING

Illustrations by the Author

Considered from the point of view of the ideal, the table lamp or, generally termed, portable lamp, should be treated merely as an architectural detail in the decorations of a room, both as to form, color and material. It should be so designed that it does not protrude itself beyond other furnishings of a room, such as chairs, picture frames or tables, but be simply a unit in one general decorative This treatment is, of course, motive. only possible under conditions where one could decorate in such lavish style that it would be possible to specially make the lamp of just the right size and general character to fit its surroundings.

For an object which is generally con-



A DEVELOPMENT OF THE CARVED WOOD STAND, WITH THE SILK SHADE.



A LAMP IN LEADED OPALESCENT AND IRRIDES-CENT GLASS, WITH GREEN BRONZE FITTINGS.

sidered among that class of house furnishings which are used as ornaments in a room, the lamp takes a peculiar position. It is not what might be termed bric-abrac, in which class most movable ornaments, such as bronzes and clocks, are placed, as it bears a decidedly utilitarian quality, that of giving light, although its necessarily conspicuous position in a room demands that it be ornamental, and is generally more so than the fixtures used for general illumination.

This quality of being a movable ornament has put the table lamp quite outside the consideration of consistent decoration and has given it a field where it has wandered off by itself, to undergo a good many weird and wonderful developments. Its unlimited scope with regard to style, size, color and material has been the means of bringing into the artificially lighted part of the world some very beautiful objects



"TREATED MERELY AS AN ARCHITECTURAL DETAIL IN A ROOM."

and also some very shoddy looking specimens of handicraft.

Of course the first function of the lamp is to give light, and it should be good light, of such a quality that is good for reading; but it is not necessary for that light to be of such strength as to illuminate an entire apartment; in fact, it is better that it should be somewhat toned

and softened above the level of where it is most useful for reading, for a steady, brilliant light should not be set low. Nothing is more trying on the eyes than some of the cut and clear glass table lamps which are in use. There seems small excuse for inverting a cut glass bowl and putting a light inside to dazzle and bewilder the optic nerves the way some of



A LEADED GLASS SHADE, WITH GILT BRASS PORT-ABLE IN LOUIS XIV. STYLE.

these types of table lamps will do. Very beautiful fixtures may be made of cut glass, but they must be kept up above the line of constant vision.

Some very practicable and serviceable lamps are made with blown or moulded shades of soft colored glass and have received the consideration of some very ingenious designers, but, like all glassware which is subject to much handling, they are rather destructible, due to accidental breakage.

The lamp made with an ornamental metal or carved wood stand and a silk shade has undergone many pleasing and attractive developments and lends itself to its use in places where lamps of blown or leaded glass may not be consistently used, it being particularly adaptable to rooms which are decorated in the French styles of the seventeenth and eighteenth centuries.

After the general introduction of the electric light the silk shade was turned to as the best material for the shading of the light, while its use made possible the simplifying of the carrying out of a general color scheme. It is still of great

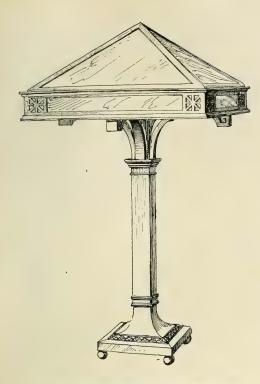
value as a more or less temporary contrivance in decoration, but, unfortunately, like all dyed materials, soon becomes faded and worn from exposure to daylight and the wear of handling and cleaning.

The invention of opalescent glass brought into the field of lamp making a host of the wonderfully beautiful and charming creations of some of our leading jewelry and fixture houses, which were naturally followed up by clever imitators, and the leaded glass shade of to-day is an object whose use is most widespread, its adaptability to any color treatment, its possibility of treatment with regard to endless forms, and the natural beauty of the material placing it in the category of the things which are necessary in the home.

The selection of any piece of furniture or ornament which one must live with should naturally be chosen to harmonize



MODERN FRENCH PORTABLE LAMP, WITH ORNA-MENTAL BLOWN SHADE.



A METAL SHADE, WITH OPALESCENT GLASS SET IN.

as near as possible with its intended surroundings, and the lamp, being a very important factor in the general appearance of a room, should be carefully considered for both its light-giving quality and color scheme.

Many people do not remain in any one abode for an extended period, and the lamp may be compelled to be used in connection with various colors or tones of wall decoration. A general neutral color, such as certain soft, warm tones of yellow, would be best where changes of surroundings are likely to occur, being sure not to have the colors in the design in too bright contrast.

The use of green in its many variations, from yellow-green to the cooler blue-green, seems to be the most satisfactory color for general use. It is the least trying on the eyes when the light is in use and is least conspicuous in the room under daylight conditions if it is of a yellowish or neutral tone. The use of green as a body color also leaves great scope for the use of other colors which are desired in what is called the trim, whether the design be one of natural forms or conventional ornament.

Electric portable lamps are also made with a glass shade having a metal overlay and many possess good qualities with regard to design, but the use of a shade in which the metal predominates is almost as objectionable as a shade in which the colors are glaring and discordant. It may look well in daylight, but will have a tendency to throw ugly shadows about the room and have a very spotty appearance when in use.

The effort should be made in both the designing and selection of a lamp to have the colors quiet and restful to the eye and the form and construction consistent with one's decorations. This will give an ornament to live with which will not tire or wear, but will become more pleasing and satisfactory upon long association.



A METAL SHADE, BACKED WITH GLASS, IN WHICH THE METAL WORK IS SOMEWHAT OVERPREDOMINANT.

Artificial Light for Matching Colors

A New Form of Electric Arc Lamp Developed for This Purpose

The part which color plays in modern manufactures well represents the enormous strides which have been made in the practical applications of science. The first great impetus given to the commercial application of color was the discovery of a dyestuff made from coal tar, which was the forerunner of the endless variety of so-called aniline dyes, which have completely revolutionized and popularized the art of dyeing. Not only has this discovery afforded means of producing every conceivable tint and shade of color with every material susceptible to the dyeing process, but has so cheapened the process that it is applicable to articles of the most common use and of the lowest cost. Curiously enough, the first aniline dye to be discovered was purple, the color which in ancient times was a synonym for royalty on account of the exceeding expense of producing it, the source of this dye being a minute marine shellfish. While the development of pigments has been much less



THE NEW COLOR MATCHING ARC LAMP.

marked, since the problem is infinitely easier of solution, it has no doubt made substantial progress, the aniline dyes themselves having no small part in the advancement.

The second epochal event in the commercial use of color was the three-color process of printing, the possibilities of which were first expounded by Mr. F. E. Ives, an inventor whose work entitles him to rank with Welsbach and Edison, but whose name is practically unknown outside of scientific circles.

The total result of all these discoveries is that color is now applied to an enormous number of manufactured articles to which it was entirely unknown a half century ago. Even the penny newspaper is now illustrated in colors, and the penny stick of chewing gum delivered from the slot machine is put up in a colored wrapper. The story is told of a landscape painter whose attention was called to the brilliant coloring in a sunset sky, which he dismissed with the comment that "it did very well for nature." While we are not prepared yet to vaunt our superiority over nature in the production of color, it can be truthfully said that there is no tint or hue of sunset sky, or flower petal, or glinting shell that the scientific colorist of to-day cannot reproduce, either with dyes or pig-

Let us make a rough inventory of the arts and manufactures in which color is an important element. The textile industry stands first in the value of its product, in number of employees, and in wages paid; and probably three-quarters of all textiles are colored.

Printing is another of the great modern industries. If we include in this all processes by which pigments are mechanically transferred from surfaces of specially formed blocks to other surfaces it would involve the production of wall paper and a great variety of printed fabrics, as well as all lithographed articles, which include metal surfaces, the enormous extent of the art of printing will be recognized, and

also the extent to which color is employed

in the various processes.

Color is also applied to a considerable extent to leather and its products. Paints and pigments form another branch of industry involving a large use of color.

Beside the artificial use of color there are many natural products in which it forms an important consideration. Flour, the material of the staff of life, is graded by its color; tobacco and mineral oils are likewise classified, and the list of minor cases where color is of commercial consideration is far too long to produce here.

Color is entirely a matter of comparison, and at the last analysis is a property of light. Thus, we see red when certain kinds of radiation enter the eye, and by a very common figure of speech we call an object red when it reflects only this par-

ticular kind of rays.

The color of an object, therefore, is entirely a matter of the kind of light that falls upon it. Sunlight being the most largely used is naturally taken as the standard in considerations of color. In other words, the apparent color of an object is always assumed to be that which it shows under normal daylight illumination.

It is a fact familiar to every one that all kinds of artificial light change this color appearance more or less. It follows then that in all cases where colored objects must be recognized and discriminated with reference to natural light the process must be hampered, if not altogether made impossible by the use of artificial light. The effect of this restriction upon industry is very considerable. While modern light-sources have made it possible to conduct all kinds of work, which do not involve color conception, quite as well by night as by day, thus doubling or trebling the possible output with a given plant, for the other class of work even the ordinary working day must often be curtailed for lack of sufficient natural light.

The production of light artificially, which has the same composition or color

quality as daylight, is therefore a problem which affects a large commercial interest. With the cheapening of the means of producing light the possibility of securing an illumination of daylight value by a process of absorbing, or taking out the rays that are in excess, is worth practical consideration, and has received considerable attention within the past few years. Sufficient success has now been attained along these lines to justify the manufacture of a lighting unit designed to give white light upon a commercial scale.

The basis of this device is a perfected form of the familiar carbon arc lamp, which has been called an "intensified arc. By using the highest quality of carbons, in connection with a perfected regulating mechanism, a light of almost perfect steadiness and color is produced with a high degree of efficiency. The light from this arc is projected through a specially designed filter, which is placed in the bottom of the enclosing hood, as shown in the illustration. This filter consists of tinted glass arranged in an ingenious manner so as to cut out exactly the right amount of rays to bring the balance to daylight color. Of course this means a loss of some of the light, but even so, the device is more economical than the oldtime methods of ordinary illumination.

The lamp so equipped is intended for use where colors must be matched, or their tints accurately observed. such a lamp could be hung over one end of a ribbon or silk counter enabling the customer to accurately match goods without the necessity of going to a window. In a similar way it could be used in color printing establishments so that the correct kind and amount of ink could be determined by night as well as by day; and a hundred other similar uses would suggest themselves to different readers. By such illumination not only could the artist work at night, but paintings could be observed in their true color values.

White artificial light marks another step in the wonderful progress of scientific illumination,

The Hygienic Value of Gas Lighting

A Reply to Mr. Scheible's Article on the Subject in Our Last Issue

By R. F. PIERCE

Happily the co-ordinate application of engineering methods and modern constructive selling ideas to the development of both gas and electric lighting in America has eliminated to a large extent the scurrilous slanders and venomous recriminations which are all too frequently called upon to do duty as selling arguments (?) under less fortunate circumstances.

Occasionally some overenthusiastic "ad-smith" will skate perilously close to the edge of criminal libel in attempting to patch together the exploded fallacy of air vitiation by gas lamps, but it is rarely indeed that matter of this sort emanates from responsible sources.

Inasmuch as the popular notions on this subject have been founded upon what are now universally regarded by hygienists and engineers as erroneous premises, it is surely allowable for the advocate of gas lighting to undertake the enlightenment of the public upon this subject. Such an effort involves no disparagement of electric lighting, but seeks only to obtain for gas lighting its just dues, and the propriety of this course has never been seriously questioned, except by those whose intensely partisan minds preclude sober judgment and the impartial elucidation of the truth.

In the September, 1911, issue of THE ILLUMINATING ENGINEER the writer included in a general survey of this subject the results of tests by Dr. Samuel Rideal, published in the Journal of the Royal Sanitary Institute. This body, to say the least, is one of the most noteworthy organizations dealing with questions of hygiene, and the experiments of Dr. Rideal are by common consent the most painstaking, complete, impartial and authoritative ever undertaken in this field of investigation. While Dr. Rideal's results were published over four years ago, his procedure has never been criticised, nor his results challenged by any competent authority.

It is, therefore, quite amusing to see the

frantic efforts of Mr. Albert Scheible to cast discredit upon Dr. Rideal's investigations by the random and reckless use of half-truths and untruths, conveyed in language replete with more or less clever insinuation, but totally lacking in either evidence or sound argument. Mr. Scheible inserts the words "alleged," "purported," etc., wherever he thinks they will do the most good, without the least justification.

Taken piece by piece, Mr. Scheible's argument disintegrates into nothingness and vanishes into thin air.

The burden of Mr. Scheible's criticism is contained in the allegation that Dr. Rideal showed an "amazing disregard" of "having the conditions typical of the average met in indoor lighting."

He also attempts to convict the writer of giving implied approval to the validity of tests made with now obsolete equipment.

It may be said at this point that the cheapest and easiest method of assailing otherwise incontrovertible proofs is charging the deviation from typical conditions—by the simple expedient of making "typical conditions" mean anything the writer chooses.

In general, the conditions to which Mr. Scheible objects are:

First.—The use of clear carbon filament electric lamps instead of frosted tungsten lamps.

Second.—The conducting of the test in rooms alleged to contain an "unusual" amount of door and window space and exceptional ventilating and heat radiating facilities.

Taking up the first consideration, it is obvious that it can only affect two of the tests made, viz.: The temperature rise test and the ophthalmic test.

As regards the first, the original report shows that the electric lighting equipment of carbon filament lamps consumed current having a heat equivalent of 658 B. T. U.'s per hour, while the net calorific

value of the hourly gas consumption was 1382 B. T. U.'s. Had tungsten lamps been substituted the reduction in the B. T. U.'s represented would have amounted to roughly 438, or 32 per cent., of the total B. T. U.'s contributed by the gas lighting installation. From the photometric determinations, however, we find that with fairly similar distribution characteristics the effective illumination on the table was about 50 per cent, greater and the total light output 30 per cent. greater with the gas installation, so that the reduction of the gas consumption to entirely compensate for the decrease in heat obtained by substituting tungsten lamps would still leave a surplus of illumination in favor of the gas light. It is evident, therefore, that in the absence of other tests to the contrary, this discrepancy is insufficient to justify a criticism of the general application of Dr. Rideal's results. It is worth noting at this point that Mr. Scheible does not cite a single test to support any of his assertions, though he rails loudly at the "insufficient data" submitted by the writer.

Regarding the ophthalmic test, Mr. Scheible assumes that the superior showing of gas light is to be attributed to the brilliancy of the unscreened electric lamp filament, stating that the lamps were surrounded only by a short fringe 25 in. in diameter. This is not only entirely unwarranted, but a deliberate distortion of the facts. The "short" fringe was a silk flounce, white inside and red outside—12 in. deep.

Mr. Scheible's assumption that the eyes of the subjects were subjected to the direct glare of the lamps is absolutely gratuitous and entirely unsupported by evidence. In line with Mr. Scheible's insistence upon average practical conditions, one might inquire as to what proportion of electric lighting installations is so made that it is impossible for the eye to encounter the direct glare of the filament. Certainly the ordinary bowl-frosted lamp does not ordinarily achieve this result, except in certain positions.

The writer did not attempt to account for the superiority shown by gas light in the ophthalmic tests. This test was quoted as being the only authoritative one available made under practical working conditions. An inspection of the drawing showing the installation indicates that it would be practically impossible for any of the subjects to have encountered the direct glare of the bare filament and the explanation of the results must be sought elsewhere.

Mr. Scheible's criticism that conditions of the test were exceptionally favorable to ventilation and heat radiation are not at all convincing. He lays great stress on those tests in which the fireplace and ventilators were open, but the test shows practically as good results with ventilators and fireplace closed.

This Mr. Scheible artlessly attributed to the fact that the fireplaces might not have been "hermetically sealed."

As a matter of fact, even a room with solid walls throughout is not by any means hermetically sealed, and if so, would be unfit for human habitation.

He also gleefully records the fact that on some occasions the wind was blowing, a "condition not met with in practise" presumably, and this from a resident of Chicago.

If Mr Scheible will take the trouble to glance over the test he will find that the greatest ventilation was by no means coincident with high winds, some of the highest figures being taken on calm days.

Mr. Scheible also objects strenuously to the excessive window area, referring only, of course, to the room containing the greater window area. The test shows that practically as good results were obtained in the room with *lesser* window area—two small windows in a room 14 x 16 ft., 4½ in.—certainly not an "excessive" amount of window area in a building intended for human habitation.

Another "amazing discrepancy" with "practical" conditions discovered by Mr. Scheible is the fact that the ceilings contained steel joists, though just when the use of steel in building construction became obsolete in America, Mr. Scheible does not state.

Altogether, his presentation of the subject betrays either a woeful lack of common sense or an equally deplorable disposition to rely upon a disingenuous distortion of facts to carry his point.

It is certainly worthy of note that he has not attempted to bring forth one iota of evidence in support of his contention, but has relied entirely upon theoretical assumptions, not even founded on good theory.

This subject merits an investigation based upon something more substantial than idle speculation and dialectical dexterity. When equally exhaustive tests indicating the opposite of Dr. Rideal's results shall have been reported, it will be time to question the accuracy of his conclusions.

Until then the fair-minded engineer must admit that in buildings otherwise fit for human habitation, gas lighting as ordinarily done possesses no hygienic disadvantages, and if properly designed may present decided advantages.

Outline Lighting on the Temporary City Hall, San Francisco, Cal.

The rise of a new San Francisco on the ruins of the disastrous fire and earthquake of several years ago has been marked from the beginning by an unusual use of illumination. In this the citizens have shown the buoyancy of their own spirits, and have dispelled the darkness and gloom of

disaster with the readiest and most effective means within reach. Hardly had the streets been clear than spectacular and decorative lighting systems were installed.

This happy effect of light has been utilized to the full in outlining the new temporary City Hall. A view of the



THIS ELABORATE LIGHTING DISPLAY ON SAN FRANCISCO'S CITY HALL COSTS BUT FORTY CENTS AN HOUR.

front of this building is shown in the illustration, which clearly indicates the very effective method used to bring out the architecture, as well as to make it an object of interest and inspiration by night. As simple as the architecture is, it is enhanced into a really beautiful façade by this lavish use of light.

The installation is in itself a model of up-to-date methods. The tungsten lamps used for the outlining are 5-watt size, running at 12 volts from a current supplied by special transformers located in recesses in the front of the building and behind the balconies; 2,540 lamps are thus used. Besides this outlining, the balconies are lighted with 40-watt tungsten lamps inside of 12-inch frosted globes. The building has a frontage of 200 feet, and, notwithstanding the lavish use of outline lighting, the expense for current is but 40 cents an hour.

The "Grand Old Man" of the Central Station Industry

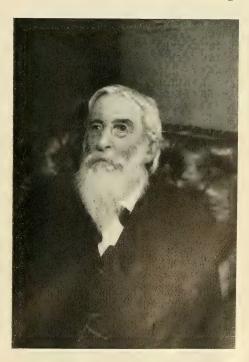
Austin C. Dunham, for Thirty Years President of the Hartford (Conn.) Electric Light Company

Accepted theories and popular notions sometimes get a serious jolt. The West has kept up such an eternal clatter about its progress and progressiveness that many have come to believe that the East has long been in a state of hopeless stagnation. And, again, the ubiquitous American youth has so often snatched the reins of management from his elders and succeeded in carrying his fares without dumping them into the ditch, that we have come to think that the last half of the span of life had become a time only for retrospection and slippered descent into the grave—a view which was furthered by the half-joking remark of Dr. Osler some years ago. Now, it is a cheerful fact that the average Westerner is a good hustler; he has to be to meet competition and knock a living out of the raw material at his command. And it is also a cheering fact to observe many successful young men in executive positions; but neither of these observations prove that the East is moribund, or that men lose their usefulness with their youth. In witness whereof the career of the subject of this sketch is put in evidence.

While it is a very sweeping statement, we set it down and challenge its successful contradiction: All things considered, the Hartford Electric Light Company under the direction of Mr. Dunham was the most progressive central station in the

United States. Mr. Dunham retired from his duties as president on February 13, 1912, after thirty years' continuous service, and at the age of seventy-nine years.

Both his term of office and his age



AUSTIN C. DUNHAM

have fairly entitled Mr. Dunham to a complete cessation of work; but while relief from the routine executive duties will be welcome, let not the conclusion be drawn that the effective work of this veteran in the development of the electric industry is to cease. With all his time to devote to research and investigation we shall doubtless have occasion to reap the benefits of his genius for a considerable number of years to come.

In the use of electricity for light, the Hartford Electric Light Company, under Mr. Dunham's administration, was the first to introduce extensively the alternating current inclosed arc lamp and the constant current alternating arc light system. The Nernst lamp was first put into practical use, and the tungsten lamp was first used for street lighting by this company. While the subject of rates for light was being tangled up by questions of "readiness to serve," "maximum demand," "fixed charges," and phrases with which the average consumer knew as little as he did about watts and volts, Mr. Dunham cleared away the confusion with one sweep by introducing the "flat rate"—that is, a stated sum per month, depending upon the size of the house, in the same general manner that water rates are usually figured. course, the usual "can't-be-done" mutterings were heard at this proposed subversion of the prevailing practises of the time; but as in many other notable instances, the thing that could not be done

was done, and most successfully. The Hartford Electric Light Company collects an average of over ten dollars from every citizen, with the said citizen entirely satisfied with what he gets for his money.

Mr. Dunham has a curious old-fashioned notion-or is it new-fashioned?that a contract, in order to be enduring and useful, must give equal advantages to both parties. If electricity is a good thing -and who doubts it?-then both those who buy and those who sell should benefit as nearly equally as possible. This general proposition is sufficient to account for the phenomenal sum of ten dollars per capita in the chief city of the State that is most noted for its closeness and shrewd-

ness in making bargains.

Mr. Dunham's success has undoubtedly resulted not only from his ability to discern practical improvements in methods and apparatus, coupled with a courage to put them into use without waiting for the example of others, but also to a personality that impresses itself deeply and permanently upon those with whom he comes into contact. No intelligent man can spend a half hour with this venerable scientist and executive without carrying away with him and retaining always thereafter a distinct and pleasant impression of one of the most genial, whole-souled, and far-sighted of men. His character, his career, and his methods will furnish a profitable subject for study by any young man who aspires to success in electric or public utility enterprises.

The Growth of Ornamental Street Lighting

How the Movement Has Swept the Country

By S. G. HIBBEN

It is often interesting to pause for comprehensive views of certain movements and to contemplate the extent and the growth of novel departures from the beaten paths of doing things; for the measure of the stability and popularity, or, what amounts to the same thing, the success of any movement, is incontrovertibly shown by just such extent and growth.

For such a reason this brief survey of the status of ornamental tungsten street lighting is given. So much has been written concerning this method of lighting business thoroughfares, and about "Gay White Ways" springing up here and there throughout the country, that the question has become more and more worthy of a general survey. The movement for such lighting might still be considered a novel departure in street equipment, but, though novel, yet it is certainly not untried, as can be seen from the number of cities where such systems are in operation.

How and where the tungsten street lighting has grown is shown through the accompanying illustration of the map, upon which these installations appear as black dots. These dots are the geographical locations of cities where, as far as can be determined, there are installations of five dozen or more lamps and globes on special ornamental posts.

There are two hundred and twenty of these installations, counting the cities in the United States and Canada, and a few insular cities. There may be several more which have unintentionally been overlooked, or are so recent as to have been

omitted from this article.

In retrospect it is probably safe to say that there were not fifty of the strictly ornamental tungsten street lighting installations one year ago. This is considering, of course, only such systems as consist of one or a cluster of filament lamps and equipment, supported on posts constructed entirely for that purpose, and distinct from decorative arches, festoons and accessories like arc or electrode lamps. Certainly two hundred of these lighting systems represented by the dots have become operative within the last two years. Shortly previous to that time the available street lighting equipment was constantly changing, as certain new types of flame and luminous arc lamps were placed on the market, and as the tungsten lamps were being perfected. These changes undoubtedly tended toward the awakening of new ideas for street lighting and deco-These new ideas were directed toward giving broader scope to the possibilities latent in business street lighting equipments. Whereas street "lighting had meant an expenditure for the largest measurable amount of light directed upon the roadway, it now came to mean an investment for attractiveness and trade benefits as well.

With a total of over two hundred installations, the increase this last year amounted to, roughly, 300 per cent.

Granting this same rate of growth to hold good for two summers to come—not an especially optimistic prediction—we would expect this tungsten lighting system to have been extended to at least fifteen hundred American communities by 1914.

As to geographical location, the eastern central section of the country can boast the majority of such attractively lighted business streets. This is to be expected on account of this section being a thickly populated one. But in the New England and far eastern States, even though quite as well populated, there are found fewer such cities. The condition is explained by knowing that the Eastern cities have been the first to need street lighting and have previously given thought to it. Therefore in them we find installations that were the best when first made, and even though not the best to-day, yet have not become inadequate nor obsolete to the point of being abandoned in favor of the tungsten system.

The most rapid growth of ornamental lighting is predicted to come in the West. New centers of population will become established there, and in these smaller growing towns an installation will mean but the first cost rather than a more expensive replacement of an existing system and a scrapping of present equipment.

Surely a brief contemplation of the sturdy growth of the ornamental street lighting makes clear the impossibility of this idea being a passing whim or a temporary caprice. And truly the strong intrenchment of ornamental lighting in progressive and deliberating communities proves that the system is not one that has been promoted and fostered for the sole purpose of exploiting manufacturers' wares.

The next step may be a change in the form of light-giving source. Tungsten lamps may be supplemented by lower power-consuming arc lamps whose intrinsic brilliancy or glare will be less than at present. But whatever the character of the source, the general idea has come to stay, for we have only to note the growth of the ornamental tungsten system and be convinced of its efficacy. Indeed, "Nothing succeeds like success."

The shortness of this article makes it

impossible to do any more than enumerate the bare list of cities where installations have been made and are being used successfully. Such a list follows:

CITIES WITH ORNAMENTAL TUNGSTEN LIGHTING INSTALLATIONS

Aberdeen, S. D. Alameda, Cal. Albert Lea, Minn. Alexandria, La. Altoona, Pa. Ames, Iowa. Atlanta, Ga. Atlantic City, N. J. Auburn, N. Y. Augusta, Ga. Aurora, Ill. Baltimore, Md. Battle Creek, Mich. Bay City, Mich. Bedford, Iowa. Beloit, Wis. Billings, Mont. Bisbee, Ariz. Blissfield, Mich. Bloomington, Ill. Bloomington, Ind. Blue Island, Ill. Boston, Mass. Brainerd, Minn. Brampton, Ont., Can. Brookfield, Mo. Brooklyn, N. Y. Brazil, Ind. Bucyrus, Ohio. Buffalo, N. Y. Birmingham, Ala. Butte, Mont. Cairo, Ill. Canton, Ohio. Casper, Wyo. Cedar Rapids, Iowa. Charleston, S. C. Charlottetown, P.E.I. Cheyenne, Wyo. Chicago, Ill. Cincinnati, Ohio. Clear Lake, Iowa. Clinton, Mich. Columbus, Ohio. Columbus, Ga. Dallas, Tex. Dalton, Ga. Dayton, Ohio. Davenport, Iowa. Deadwood, S. D. Decatur, Ill. Denver, Colo.

Des Moines, Iowa. Duluth, Minn. Elmira, N. Y. Elwood, Ind. Emporia, Kan. Enid, Okla. Evansville, Ind. Fargo, N. D. Faribault, Minn. Fayette, Mo. Fort Atkinson, Wis. Fort Dodge, Iowa. Fort Smith, Ark. Fort Wayne, Ind. Fort William, Ont., Can. Fort Worth, Tex. Frankfort, Ky. Frederick, Md. Fremont, Neb. Gary, Ind. Glasgow, Mont. Grand Forks, N. D. Grand Rapids, Mich. Great Falls, Mont. Green Bay, Wis. Greenfield, Ind. Grinnell, Iowa. Grosse Pointe Farms, Mich. Guelph, Ont., Can. Hamilton, Ohio. Hamilton, Ont., Can. Hannibal, Mo. Harlan, Iowa. Harward, Neb. Hoopeston, Ill. Houston, Tex. Independence, Kan. Indianapolis, Ind. Indianola, Iowa. Iowa City, Iowa. Jacksonville, Fla. Jamestown, N. Y. Joliet, Ill. Kalispell, Mont. Kansas City, Mo. Kendallville, Ind. Knoxville, Tenn. Kokomo, Ind. Lansing, Mich. Laramie, Wyo.

La Salle, Ill. Lenox, Iowa. Little Rock, Ark. London, Ont., Can. Longmont, Colo. Los Angeles, Cal. Louisville, Ky. Macon, Ga. Madison, Wis. Manila, P. I. Mankato, Minn. Marion, Ind. Marshall, Mich. Marshalltown, Iowa. Marshfield, Wis. Mattoon, Ill. Milwaukee, Wis. Minneapolis, Minn. Minouk, Ill. Mishawaka, Ind. Mobile, Ala. Monroe, Mo. Montgomery, Ala. Montreal, Can. Mt. Clemens, Mich. Nashville, Tenn. Nashvauk, Minn. Newark, N. J. Newark, Ohio. New Philadelphia, Ohio. New York, N. Y. Niagara Falls, N. Y. North Vernon, Ind. North Yakima, Wash. Oakland, Cal. Oklahoma City, Okla. Omaha, Neb. Oskaloosa, Iowa. Ottawa, Ont., Can. Paullina, Iowa. Pana, Ill. Pasadena, Cal. Pasco, Wash. Pensacola, Fla. Peoria, Ill. Peru, Ill. Phoenix, Ariz. Pine Bluff, Ark. Port Arthur, Ont., Can. Portland, Ore. Portsmouth, Ohio. Poughkeepsie, N. Y. Pullman, Wash. Quincy, Ill. Racine, Wis. Reading, Pa. Regina, Sask. Richmond, Ind. Richmond, Va.

Riverside, Cal. Rochelle, Ill. Rochester, Minn. Rochester, N. Y. Rockford, Ill. Rock Springs, Wyo. Rock Island, Ill. Rushville, Ind. Saginaw, Mich. Salisbury. Mo. Salt Lake City, Utah. Sandusky, Ohio. San Diego, Cal. San Francisco, Cal. Savannah, Ga. Schenectady, N. Y. Scranton, Pa. Seattle, Wash. Sedalia, Mo. Seneca Falls, N. Y. Shawnee, Okla. Shelbina, Mo. Shreveport, La. Sioux City, Iowa. Sioux Falls, S. D. South Bend, Ind. Spencer, Iowa. Spokane, Wash. Springfield, Ill. Springfield, Ohio. Springfield, Mo. St. Catharines, Ont., Can. St. Joseph, Mo. St. Paul, Minn. Stony City, Iowa. Superior, Wis. Syracuse, N. Y. Tacoma, Wash. Tampa, Fla. Taylorville, Ind. Terre Haute, Ind. Toledo, Ohio. Topeka, Kan. Toronto, Ont., Can. Twin Falls, Idaho. Valparaiso, Ind. Vancouver, B. Can. Victoria, B. C., Can. Virginia, Minn. Walla Walla, Wash. Warren, Ohio. Washington, D. C. Waterloo, Ont., Can. Wausau, Wis. Wichita, Kan. Wilkes-Barre, Pa. Winterset, Iowa. Winnipeg, Man., Can. Youngstown, Ohio.

A New Treatment of Metal and Art Glass in Lighting Fixtures

Some Designs Which Embody the "New Thought" in Decorative Art

The tendency to get away from the traditional chandelier both in the mechanical and artistic elements shows a constantly increasing strength. The methods of construction inherited from the days of the candle and oil lamp, and the motives of decoration of almost equally ancient lineage, that have so long dominated the fixture manufacturer, are unquestionably losing the firmness of their grip. Custom is, perhaps, nowhere more persistent or tyrannical than in matters of art. That questions of taste do not admit of dispute is a very old dictum; and where there is no opportunity for argument or reason there is small chance of progress. But with a naturally progressive and restless people change in matters of art, for better or for worse, must arise from sheer



FIG. I .- AN ELABORATE DINING ROOM DOME.



FIG. 2.—A DOME SUGGESTING LOUIS XVI. PERIOD OF DECORATION.

weariness of the endless repetition of traditional forms. In no field of decorative art is there more occasion for this weariness of monotony than in lighting fixtures. Any indications, therefore, of original conceptions and departures from time-worn ideals is sufficiently inspiring to attract interest and attention.

A type of fixture that has justly come into very large use, and is characteristic of the newer illuminants, is that known as the "dome." A fixture of this construction was impossible before the invention of the electric lamp and the mantle gas burner. The popularity of the dome seems to suffer no abatement, nor is it likely to, since this type of fixture possesses to a high degree the elements of both util-



FIG. 3.—A SEMI-INDIRECT FIXTURE IN ART GLASS.

ity and beauty. When properly constructed, and especially when adapted to the use of the new forms of electric and gas lamps, the dome is an ideal lighting unit for domestic use. At the same time it offers an almost unlimited field for the designer to display his artistic abilities.

In Fig. 1 is shown a dome in which the metal work is the chief decorative feature, being worked out in an elaborate design of filigree and carving. The elaboration and fine detail is permissible in this type of fixture for the reason that it is necessarily hung comparatively low, and hence is seen at close range.

Fig. 2 shows another design in the same general treatment, but with a contour of novel outline. The motive is suggestive of the Louis XVI period. While any desired finish can be given to metal work, dull gold would be most naturally chosen for these designs.

Fig. 3 shows a bowl fixture in which the art glass sections are entirely overspread with metal tracery. While the interior arrangement is not shown, the fixture is evidently intended as a semiindirect unit and should be provided with a Holophane or white glass reflector to direct the light to the ceiling. Semi-indirect lighting is exceedingly pleasing in its effect from the standpoints of both usefulness and decorative effect. In this case it combines the richness of stained glass with the artistic skill of the metal worker's art. The one discordant element in this fixture is the ceiling canopy, which is an ordinary stamping and out of harmony with the metal work of the bowl. Furthermore, the short stem used for the purpose of allowing the canopy to be dropped still further detracts from the general effect. A hexagonal canopy split so as to avoid the necessity for dropping would add greatly to the appearance of the fixture.

Fig. 4 shows the same fixture with the addition of pendant lamps, thus affording means for both direct and indirect illumination. The same criticism in regard to the canopy applies as in the preceding, but with this exception the fixture is fresh in its artistic motive and pleasing in its lines and proportions.

Fig. 5 shows a combination of ceiling placque and the so-called "shower." The



FIG. 4.—A COMBINATION, SHOWING EFFECT WITH SEMI-INDIRECT BOWL.

design is distinctly of the Arts and Crafts motive, and the general effect is good. The ceiling placque serves only the decorative purpose of showing the rich coloring of the art glass, but the pendant lamps, if fitted with translucent reflectors within the art glass shades, would furnish an efficient and pleasant illumination, as well as exhibiting its artistic merit.

Fig. 6 is a modification of the chandelier type and is shown principally to



FIG. 5 .- A CEILING PLACQUE AND SHOWER.



FIG. 6.—A CHANDELIER IN METAL AND ART GLASS.

illustrate the proper treatment of the ceiling canopy, although in this case the objectionable stem below the canopy is retained. The metal and art glass shades are exceedingly handsome and there is no reason why the fixture should not be an efficient and serviceable lighting unit.

YOUR INDULGENCE, PLEASE

The indulgence of our readers is earnestly requested for our delay in bringing forth our April issue. The delay is due to the reorganization associated with the retirement of E. Leavenworth Elliott as Editor and President of the Company, which went into effect April 1st.



FIG. I.—THE COLDWELL LAWN MOWER COMPANY'S BIG ELFCTRIC SIGN AT NEWBURGH, N. Y.

The Largest Electric Sign in the World

In the second issue of this magazine, April, 1906, there was a detailed description of what was then claimed to be, probably with accuracy, the largest electric sign in the world. This was the word "Butterick," which extended across the side of the new building occupied by this concern, the letters in the word being three stories in height. A few years later the size of this sign was eclipsed by a sign on the top of the Colgate factory in Jersey City.

This was a case of friendly rivalry of two concerns on the opposite sides of the river; but New York City and its neighbor in New Iersey have both been outdone by an historic old town on the banks of the Hudson some hundred miles above. Newburgh has historic memories, which are second perhaps only to Mount Vernon in their relation to the founder of the country, but it is almost the last place an American would expect to find the rest of the world outdone in the use of the sign made up of electric incandescent lamps.

The sign in question is in front of the works of the Coldwell Lawn Mower Company, day and night views of which are shown in the illustrations. The sign is 352 feet long and the letters are 16 feet high. The surface of the sign meas-



FIG. 2,-THE SIGN ILLUMINATED.

ured in the parallelogram containing the letters is 5632 square feet, as against 4800 square feet in the Colgate sign. Electric current for the sign is supplied by the Central Hudson Gas and Electric Company.

Outdoor Lighting for Horse Exhibit

In order to give the people who work by day a full run for their money at night, the Springfield (Ohio) Light, Heat & Power Company devised a scheme for artificially illuminating the track in front of the grandstand. An increased attendance was the result. Not only did people from nearby come to see the horses, but they were naturally curious to know what new thing electric lighting was to bring about in connection with the horse show itself.

Just what the horses thought about it can hardly be determined; but so far as observers could tell, they deported themselves at least no more foolishly than they do under ordinary daylight conditions, and for aught we know they may have enjoyed it.

At any rate, the artificial lighting was sufficient to induce the Bon Ton to assemble, and not a few in evening dress. So whether the illumination, as shown in the accompanying photograph, accomplished its full purpose for exhibiting horses, it gave the people a chance to show themselves at their best.

As shown in the illustration, 700 16 c. p. lamps were strung across the track. Holophane reflectors were used. It was altogether an economical and profitable venture, as the Horse Show Association was well repaid for the slight cost of rigging and the energy consumed for the two nights that the show was on.

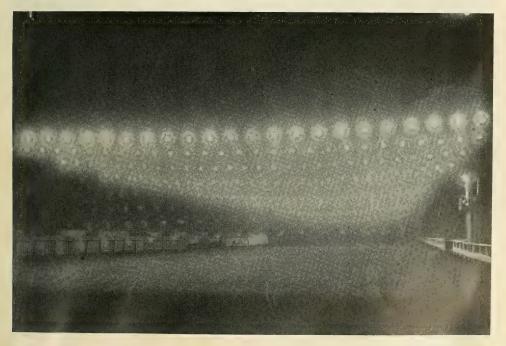


FIG. I .- NIGHT VIEW OF SPECIAL ILLUMINATION AT THE SPRINGFIELD, OHIO, HORSE SHOW.

The "White Way" in Fargo, N. D.

How the New Ornamental Street Lighting has Continued to Grow

The "White Way" in Fargo has been a growth, beginning in 1909, and steadily extending. In the beginning the property owners paid for the posts and the tenants paid for the current, the pro rata charge of 25 cents a foot being made. This continued until November, 1910, when the city took over payment for the current and maintenance, which arrangement has since continued.

There are now one hundred and fortyone posts in the city, located in the business district, each containing four 60watt Mazda lamps on the arms and one 100-watt lamp in the centre. All lamps burn until midnight, when the four smaller ones are turned off, leaving the upper lamp burning until dawn. The city has ordered the removal of all arc lamps in the district served by these ornamental posts, as it was found that they were not only unnecessary, but by contrast were unsightly.

While the installation has been made in a somewhat piecemeal manner, the general effect is highly satisfactory to the business men in particular, and the

citizens in general.

It is true in Fargo, as it has proved the case in many other cities, that the White Way "as a growth" has certain advantages. Of course, the sooner the community as a whole wakes up to the advantages of such ornamental lighting the better. But it usually works out that an example once established in the most central or im-



FIG. I.—A PORTION OF THE "WHITE WAY" IN FARGO, N. D.



FIG. 2.—ANOTHER VIEW ALONG THE "WHITE WAY."

portant business section is demanded by other sections, the merchants of the latter having become thoroughly convinced of the advantages secured by those whose stores are on the White Way. Such lighting creates content for the favored and breeds an uncomfortable sense of being "out of it" on the part of those doing business on streets where lighting is inferior.

And so it goes.





FIG. 3.—TYPE OF STANDARD IN-STALLED,





FIG. I .-- A FEW NOVEL EFFECTS IN WICKER PORTABLES FOR THE SUMMER COTTAGE OR BUNGALOW.

Portable Lamps for the Bungalow

The word "bungalow" is of oriental origin, and, while the original meaning of the word has been distorted almost beyond recognition in the thing to which

it is applied in this country, there is still in the oriental effect of wicker-ware something that naturally fits in with the bungalow idea. A lamp in theory, and



FIG. 2 .- SOME FURTHER EXAMPLES.

often in practise, in the country is a jug of oil with the necessary wick and burner attached; what is more fitting than to cover this jug, as well as the demijohn, with woven willow?

The illustrations of wicker lamps given herewith show their peculiar quaintness and oriental suggestion better than descriptive words. They are furnished

for either oil, gas or electricity as the luminant.

From the artistic standpoint, it follows as a matter of course that the willow lamp should be used in connection with wicker chairs and tables, and he who has furnished his bungalow in this manner has reached the limits of propriety, comfort and satisfaction.

Modern Suburban Lighting

How One Problem Was Solved-Gas and Electric Lighting Both Used

In a suburban district north of Philadelphia, near Jenkintown, on the Lenox road, an attractive and satisfactory installation has been made by the Philadelphia Suburban Gas and Electric Company, under the supervision of L. R. Dutton, manager.

In this neck of the woods is to be found a rather more than ordinarily high-class lot of people, and they demanded that their boulevard be lighted as well as any in the land. The architects of the houses of that community demanded that posts be installed which were de rigueur—something classic and altogether to be proud of. But, of course, it was not to cost too much. So immediately the residents and the lighting companies conferred, with the result that the design shown in Fig. 1 was selected. These posts were specially designed for this installation. The globes are 16-inch

alabaster, with 6-inch holders, with Mazda 40-watt series street lamps. The posts are located 125 feet apart and light the road and sidewalks effectively. Arrangements have been made in regard to the house service lines to connect up from the rear of the properties, thus eliminating any unsightly poles along the street.

In another section—a region known as Latham Park, and likewise north of Philadelphia—a boulevard extends some 2000 feet. Exceptionally fine residences are in process of erection on either side of the street, which is 100 feet wide and supplanted with ornamental flower beds and shrubbery running through the middle. Here also there is an entire absence of ugly poles and wire lines.

The ornamental—and highly ornamental at that—cast-iron gas posts suspend arc lamps. Five-light posts stand at



FIG. I .- DECORATIVE SUBURBAN LIGHTING NEAR JENKINTOWN, PHILADELPHIA.



each of the entrances. These lamps were designed and made by the Smyser-Royer Company, York, Pa.

The lamps used are the regular threeburner, No. 30, Humphrey outdoor inverted type, black enamel finish, with 12inch alabaster globes, fitted with special bypass lever for lighting. The central globes on the top of the posts are 14-inch size, of the same style glass. With the posts bronzed, the lamps black enameled and the globes white the contrast is attractive and distinctive.

There is no doubt that the suburbanite is demanding more and better light for his home surroundings. Just why this is may be one man's guess as good as another's. One thing is true, however—that it is not to be expected that people accustomed to ornamentally-lighted business sections can fail to be dissatisfied with anything ugly or ungainly around their homes.

As a matter of fact, the suburbanite is a man to be reckoned with, and well may holders of large suburban areas see to it that some arrangements are made for high-grade modern lighting installations for their prospective buyers. For the time is soon coming—if indeed it has not already arrived—when the average citizen will positively refuse to live in a section which is not properly lighted.

The three-light posts illustrated with two inverted Humphrey arc lamps and one ball globe upright lamp in center have arms 3 feet wide. The post is 12 feet high from base to bottom of the ball globe in the center. The base of the post is 18 inches square and the weight of the post about 400 pounds.

The following are the details of cost:		
Cost of the 2-arm post(including risers and piped cross-arms.)		
2 special inverted outdoor Humphrey arch, each \$9.50	19.00	
each	.75 4.25	
Cost hauling and erecting post on base Cost hanging and adjusting lamps	2.85 1.40	
Cost one coat finish bronze for post	1.50	
Total cost each	\$85.00	

\$50.00 to No tot lamp standards

The 4-aim post costs, each \$19.00	10. 200. 101 Tarrip Startate (13	12,50.00
4 arc lamps cost, \$9.50 each 38 00	1275 feet 2-inch fiber duct	118.00
Other costs as above for erecting 10.75	1375 feet of standard cable (insulated	
	for 600 volts)	344.00
Total cost each\$107.75	I safety coil	25,00
The destinant have seek incorporation	10 16-inch globes and tungsten burn-	
The electric posts have cast iron base	ers	
and top, with corrugated steel column,	Labor installing in an 18-inch trench	
the base of post being 18 inches in diam-	with incidental expenses	200,00

eter. The post from base to top of globe is 10 feet 7 inches. The cost of installation was made up as

follows:

Labor installing in an 18-inch trench
with incidental expenses 200.00
Total cost\$942.00
Cost per lamp
Cost per foot of installation of cable
to posts

A Twentieth Century Review of the Progress of Illumination During the Nineteenth Century

By Roscoe Scott

Persons of a speculative turn of mind have been known to sigh, "What a gratification of curiosity would it be to re-visit this old earth about a hundred years hence and note the changes in customs and conveniences that will inevitably have taken place!" While this enticing journey will presumably be denied to some of us at least, we are freely permitted to look backward and compare our present world with that which our forefathers knew. Even a casual study of the past will prove that less change has taken place during the last five thousand years along certain lines than has occurred in the last century along others. The common forms of vegetable and lower animal life have changed very little since written history began; human nature has changed considerably, though the change has been subtle; but in the art of illumination tremendous strides have been made during the memory of every living man. The following recital forms a general survey of progress in this art since the year 1800, events being grouped into ten-year periods.

The writer desires to state that his data have been obtained from so many scattered sources that to burden the text with notations of them all appears undesirable, the more so as most of the facts can be verified without special difficulty; if, however, detailed references are desired on any particular point he would be glad to furnish

them on request. A few of the dates given are subject to correction in cases where authorities disagree. If the narrative serves to impress more definitely upon readers of GOOD LIGHTING the fact that the means of artificial lighting at our beck and call are immeasurably superior to those our forefathers possessed its purpose will have been entirely fulfilled.

At the dawn of the nineteenth century there was not a single central lighting station-gas or electric-in the world; even matches were unknown, and the principal illuminant for domestic use was the tallow candle—in those days largely a "farm product "-the wick of which had to be trimmed or "snuffed" every few minutes to keep the light from going out. The oil lamp had not been highly perfected, and in any case its use would have been restricted, for there was no such bountiful supply of high-grade illuminating oil on the market as is available to-day. Whale oil was chiefly depended on for consumption in lamps, and whales were already becoming scarce.

FIRST DECADE.

The first decade of the century ushered in the gas lighting industry. In this connection two years stand out with especial prominence: 1802, when William Murdoch, the Scotchman, to whom Englishmen generally ascribe the honor of being the father of gas lighting, made his great

public display of gas illumination at the factory of Boulton & Watts, at Soho; and 1810, when the London Gas Light & Coke Company (later for many years known as the "Chartered" company) was incorporated by an act of Parliament, after a struggle of five years or more to obtain this privilege. Eighteen hundred and six also should be memorable in the annals of gas lighting, for it was in that year that the first American to interest himself actively in the subject, Mr. David Melville, succeeded in lighting with gas his home and the street on which he resided, in Newport, Rhode Island. In that same year that Melville was carrying on this work, the first gas main ever laid in a public street was being installed in London, under the auspices of Frederick Albert Winsor, the German promoter of the first gas lighting company ever incorporated, namely, the London Gas Light & Coke Company, above mentioned. Winsor, by the way, was a pupil of Philippe Lebon, the Parisian, who, working independently of Murdoch, shares with the latter the credit of having demonstrated the feasibility of lighting with coal gas.

Progress in illumination during this first decade of the wonderful nineteenth century was not confined, however, to the gas lighting field, for the first electric light known to have been kindled by human hands was produced in 1801, when Sir Humphrey Davy experimentally discovered and studied the electric arc. In much of his work Davy used for electrodes rods of charcoal heated and plunged into mercury to make them better conductors. It was not until 1809 that the discoverer publicly exhibited the arc light, using as source of energy his famous battery of 2,000 primary cells.

Among the less spectacular, yet very important, occurrences in illumination history during the years 1800 to 1810 may be noted Carcel's valuable researches on illumination with the fatty oils in 1800; the discovery of the rare metallic element osmium by Tennant, in 1803, a discovery which had to wait ninety-five years before finding its application to lamp manufacture, and the invention of chemical matches (not friction matches, though a step in their direction) by Chancel, in 1805.

SECOND DECADE.

The second decade, as far as progress in illumination is concerned, may be characterized as a period of steady elaboration of the details of apparatus used in gas manufacture, gas distribution and gas consumption. The "fish tail" gas burnerwhich of recent years, together with other open-flame types of burner, has largely given way before the mantle lamp, and yet was a great improvement over the simple circular orifices in gas pipe that served as burners in the early days—did not make its appearance until the year 1820, when J. B. Nielsen, of Glasgow, discovered that two jets of flame may be made to cross each other in such a way as to spread out into a fan-shaped sheet of flame, with increased luminosity. Among the notable inventions in the gas industry—as distinguished from the gas lamp—may be mentioned the hydraulic main, introduced by Samuel Clegg, chief engineer of the London Chartered Gas Company, in 1812; the first gas meter (a "wet" meter), devised by Clegg in 1813; the cylindrical gas holder, which first appeared in 1816, and the first dry meter, invented by John Mallam, tested in 1819.

THIRD DECADE.

The third decade of the century we find to be, like the first, a period of notable inventions, though a single one of thesethe friction match—would have been sufficient glory. This commonest of household articles was invented in the year 1827 by John Walker, a druggist of Stockholmon-Tees. Walker's first matches were tipped with gum, chlorate of potash and sulphide of antimony. They did not contain phosphorus and were intended to be lighted by being drawn rapidly through a folded piece of glass paper held in the They were called "Congreves," in honor of Sir William Congreve, the inventor of the Congreve rocket. It is interesting to reflect that while the match has been one of the chief contributors towards convenience in artificial lighting in the past, we have already reached the stage where we regard it in its turn as a nuisance to be displaced wherever possible by better means of lighting our lamps.

Until about 1826 no aspirant for pop-

ular glory had had the good fortune to "get into the limelight," for not until then had there been any limelight to get into. Henry Drummond—assisted doubtless by the previous experiments of Hare and Gurney—made use of the incandescent limelight, sometimes called the "Drummond light" or "calcium light," for signaling purposes in connection with the Ordnance Survey of Ireland in the year just mentioned, and this form of illuminant soon came into extensive use for theatres and other special high candle-power service.

While the friction or "locofoco" match and the limelight were the two most striking achievements in illumination during the twenties, it should not be forgotten that during this time gas lighting was steadily making its way into the principal cities of the civilized world. The first American gas lighting company had been incorporated in Baltimore in 1816, and in 1821 gas street lamps were installed in Baltimore. In 1822 gas was first used in Boston for street lighting. The first municipal contracts for gas street lighting in New York City were let in 1823. Looking at Germany, we find that in 1828 the first gas works in Hanover were installed, while in the next year Dresden followed suit.

FOURTH DECADE.

During the succeeding decade discoveries and inventions were made which were destined ultimately to advance the illuminating art as much as any that have above been mentioned. The most important discovery, without doubt, was the principle of electromagnetic induction, denounced by Michael Faraday in 1831 while he was Director of the Laboratory of the Royal Institution. Detailed records of the experiments which Faraday

made in arriving at this grand underlying principle on which all commercial electric generators depend are preserved in his laboratory notes, and may be traced by anyone who cares to read the published accounts of his life. The principle was not, however, to find its wide application to the furtherance of artificial illumination until several decades later. The year after Faraday's epochal observation was made, the first dynamo-electric machine, or "dynamo" on record, was constructed by Hyppolyte Pixii—it consisted essentially of a "horseshoe" electro-magnet wound with 3000 ft. of insulated wire, and of a permanent horseshoe magnet designed to revolve near the poles of the electro-mag-

The friction match was first clothed in a form like that of the common matches of to-day in the year 1833, when the phosphorus match was introduced in several European countries on a large commercial scale, superseding the "Congreve" with its glass paper accessory.

It is undeniable that much more honor is usually due to the man who accomplishes a task than to him who first suggests the possibility of its accomplishment; nevertheless, a certain amount of credit rightly belongs to the theorist who has the insight or the originality to suggest a certain line of activity. The carbon filament incandescent lamp may thus be said, without detracting in any way from the labors of those who really invented it, to have been born in the brain of Professor Jobard of Brussels, who, in 1838, suggested that a small piece of carbon, if incandesced in vacuo by electricity, might be employed as an artificial light-source. He suggested this idea to his pupil, De Changy, who did considerable experimenting without, however, producing a commercially successful lamo.

(To be continued.)



The New Era in Lighting Fixtures

How Wood and Art Glass are Combined to Produce Effects that are Both Novel and Beautiful

In our last issue we illustrated a number of lamps and lighting fixtures in which wood furnished the material of construction, with art glass serving as the means of diffusing and reflecting the light. The design of the fixtures showed a consistent following of the Arts and Crafts spirit of decorative art. Oak was the wood appropriately chosen for the purpose. In following the spirit of the Arts and Crafts school the construction was confined to the simple elements

capable of being fashioned with primitive tools. As a result curved lines were entirely omitted, the decorative effect depending upon the sense of proportion and the use of angles and parallel lines.

We illustrate herewith a number of fixtures in which the same materials are treated in an entirely different manner and with equally pleasing results. The



FIG. I .-- A NEWEL FIXTURE.



FIG. 2.—A BANQUET LAMP.

matter of choice between the two treatments, in fact, is one of those matters of taste concerning which we have long been told there is no opportunity for dispute. These designs are strictly modern and indicate in their construction and conception the methods and tools of the present advanced state of the mechanic arts. As a matter of actual fact, they are the result of special machinery designed and built for the purpose of their production. They are characterized by a free use of curved lines, in many cases the curve resulting from the bending of the wooden support-



FIG. 3.-A PIANO LAMP STANDARD.

ing elements and the art glass accessories. Mahogany has been appropriately chosen as the most serviceable, as well as the most beautiful wood suited to their construction.

Fig. 1 is a table lamp having for its standard an exquisite piece of carving of a figure in the Art Nouveau spirit. The electric lamp is entirely enclosed in the globe of bent wood and art glass. This lamp, of course, is intended for use only where a mild general illumination is required, and is rather an art object than a utilitarian light-source. The use of a human figure in various poses as a support for a lamp is very ancient in its origin and has been very often sadly abused. The representation of a human being supporting a lamp or cluster of lights out of

all proportion to its strength, or in an attitude of action from which it must instantly proceed or fall, is a flagrant contradiction of the elementary principles of art, which is by no means an uncommon spectacle. The lamp in this case, however, is free from both of these criticisms. The figure is in a position of repose, and is conventionalized just enough to suggest that it is primarily a support and not a piece of pure art, while the globe is not sufficiently exaggerated to overburden the support.

Fig. 2 is a banquet lamp which stands 42 in. high in the original. While the design makes use of no new motives, the proportions are exceedingly graceful and the decorative elements in perfect harmony and taste. The lamp, furthermore, is an exceptionally useful illuminating unit.



FIG. 4 .-- A DOME IN MAHOGANY.



FIG. 5.—A SEMI-INDIRECT FIXTURE IN WOOD.

Fig. 3 is a floor lamp. It is entirely devoid of surface decoration, except some appropriate carving at the top of the standard, the artistic effect being produced by harmony of line and graceful proportions. As an example of the pleasing effect which can be secured by these two esthetic elements this lamp is hard to excel.

In Fig. 4 we have a dome embodying the same elements of simplicity and grace of line, combined with elegance of material. The fixture is appropriately supported by a chain, the general harmony being carried out by the use of wood for the construction of the ceiling canopy.

Fig. 5 shows a suspended bowl, which the illuminating engineer would class as a "semi-indirect" lighting unit—i. e., one which would throw a portion of the light on to the ceiling while transmitting the other portion through the art glass of the bowl. This is likewise reduced to almost the lowest terms of simplicity and yet is distinctly pleasing in its lines and leaves full play to the rich colorings on the art glass when lighted from within.

Fig. 6 is a fixture of the "shower" type, the same general construction being applied to the smaller shades of the suspended lamps, while the ceiling placque displays the richness of the material to its full advantage.

While the method of construction and

materials used in these fixtures is distinctly new, it does not carry the slightest suggestion of being freakish, or merely affecting novelty. The design is mechanically in strict accordance with the materials used, having ample strength for the purpose, without excessive weight or burdensome decoration. As it is now more than a generation since the electric light came into familiar use, it is perfectly proper to assume a knowledge of its general properties. When we see an artificial light we no longer instinctively connect it with a flame, and hence it causes no surprise or mistrust when we see inflammable materials in immediate proximity to a light-source. The use of wood to support an electric lamp or the glass accessory for diffusing or modifying its light is therefore quite as appropriate as its use for the construction of any cabinet work. It is especially satisfactory to know that in putting forth what is necessarily an innovation in the method of making lighting fixtures such a thorough appreciation of the "eternal fitness of things" should be shown. Doubtless the public will show their appreciation of the wider choice afforded them by an adequate acceptance of the new materials and designs.



FIG. 6.—A SHOWER IN MAHOGANY AND ART GLASS.

Hinsdill Parsons

Late Vice-President and Counsel of the General Electric Company



HINSDILL PARSONS.

As the result of an automobile accident, Hinsdill Parsons, vice-president and general counsel of the General Electric Company, was instantly killed near Albany, N. Y., Sunday afternoon, April 28.

Although but forty-eight years of age, Mr. Parsons had shown himself to be one of the ablest corporation lawyers in the country. For nearly a dozen years he has had charge of the law department of the General Electric Company, and his abilities have been well proven in the solution of the many perplexing legal problems which naturally arose in the development of this rapidly growing industry.

In 1907 Mr. Parsons took a very active part in the work of the rehabilitation of the Knickerbocker Trust Company, later becoming one of its directors—a position from which he later retired.

He was largely responsible for the remarkable development of the Schenectady Railway Company, the Schenectady Illuminating Company and the Mohawk Gas Company—being president of the two last

named companies at the time of his death.

Mr. Parsons was a director of the Electric Bond & Share Company, the Washington Water Power Company and the Schenectady Power Company.

Mr. Parsons maintained a residence in Schenectady, where he spent considerable time during the summer, but his business affairs kept him in New York City much of the time.

Mr. Parsons was a member of the Mohawk Club and the Mohawk Golf Club of Schenectady, and was deeply interested in many other local organizations. He was also a member of the University, Metropolitan, St. Andrew's and St. Nicholas clubs, and of the Down Town Association, in New York City. He had a wide circle of friends among the leading legal and electrical men of the country who mourn his loss. He was deeply loved by all his friends and by all who knew him.

Hinsdill Parsons, a son of the late Mr. and Mrs. J. Russell Parsons, was born in Hoosick Falls, February 10, 1864, and received his higher education at Trinity College and at the Albany Law School, graduating from the latter in 1885. Four years later he was appointed patent attorney for the Walter A. Wood Harvester Company of Hoosick Falls. He became associated with the General Electric Company in January, 1894, and in April, 1901, he was elected vice-president.

As head of the law department, Mr. Parsons directed the legal affairs of the company, and was assisted at the Schenectady office and in New York by a large staff of lawyers.

He is survived by his widow, Jessie Mary Burchard, who is a sister of Anson W. Burchard, who holds the office of assistant to the president of the General Electric Company. Also by three brothers, Willard P. Parsons of Cohoes and Edgerton and Walter Wood Parsons, both of New York City.

The funeral services were held from St. George's Church, Schenectady, Tuesday afternoon, April 30.

EDITORIAL

An English View of American Decorative Street Lighting

The Electrical Review (London) of March 22 contains a contributed article on "Artistic Street Lamp Standards," which illustrates in outline the most familiar forms of lamp standards and poles used in the new street lighting in this country. The writer is enthusiastic both in his appreciation of the artistic merits of the standards and the illumination produced, and of the rapidity with which the improved lighting has been taken up on this side of the water. After referring to the fact that where municipalities have failed to promote the improved lighting the merchants and business men have come to its support by their contributions, the writer makes the following interesting comments:

"Contrast these conditions and methods with the confirmed attitude of laissez glisser, or the spasmodic 'ratepayers' agitation' (say, for six-flame arcs in a certain street), to be found in the majority of English towns, where street lighting matters are concerned, and it is not surprising to find that in the very materials employed we are much behind denizens of Canada and the States.

"The drawn-tungsten filament lamp had been boomed, tested and discussed for months in America before it commenced to attract attention on this side, and, in the manufacturing and stocking of innumerable useful types of globes, reflectors and lamp fittings in general, we are undoubtedly behind America, though fully maintaining our position in Europe."

The editors, however, do not share either the opinions or the enthusiasm of this contributor, and set forth their own ideas in a short editorial, from which we quote:

"But we must confess that we are wholly unable to share the author's enthusiasm for the beauty of these designs, some of which, in fact, we should not hesitate to call atrocious—for example, Figs. 7 and 10 on page 480. Apart from the design of the columns, there is a monotony about the spherical globes, turned upwards toward the heavens, or

drooping from their stiff supports, which to us is most unpleasing. There is not one of these designs that commends itself to us as suitable for lighting streets—from the æsthetic point of view. Chacun à son goût; we do not pose as arbiters of beauty, and others, like our contributor, may hold opposite opinions on this score, but on other grounds we may be bolder and say that several of the designs illustrated are highly inefficient for street lighting. By using a sufficient number of the columns and expending sufficient energy on them, no doubt a brilliant effect can be secured; but where severe competition has to be met, and the streets must be adequately lighted at the minimum cost—the conditions which obtain in this country—hardly any of the designs shown can be seriously considered."

The designs which are branded as "atrocious" are shown below.

Of these, the design at the left is manifestly not intended for street lighting, but as an architectural decoration for the entrance to a large building. The figure

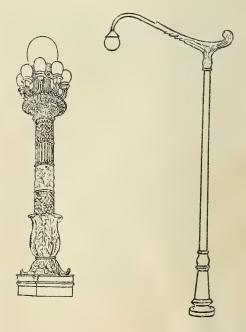


FIG. 7.

FIG. IO.

at the right is a preliminary sketch from which was developed the standard used in New York, which is shown in another section of this issue, and which has met with the approval of the Municipal Art Commission of the city. As our English contemporary remarks—in French—"everyone to his taste"; the Briton relishes his "high" game, the Teuton his limburger cheese, the Gaul his snails, and the American his pie—and his "atrocious" lamp standards and street illumination. And so we are all happy in our own delusions. "Where ignorance is bliss 'tis folly to be wise."

Decorative Street Lighting as a Means of Livening Up a Town

So much has been written and said in recent years on the commercial value of good street lighting to a municipality that to attempt to add anything to the arguments would seem like a useless "elaboration of the obvious." The citation of a practical example, however, may not be amiss.

In a recent issue we gave a description of the street lighting system recently installed in New Haven, Conn., which was the first of its kind, using a new modification of the new inverted series luminous arc lamp. New England, like her older namesake, does not aspire to the reputation for hustle and "progressiveness," upon which our Western neighbors lay so With the full knowledge much stress. of the solid foundation of her innumerable industries, of the thrift of her citizens, of her great but unostentatious accumulations of wealth, and her various worldfamed seats of learning, she has been content to let her Western neighbors enjoy what to her was only an unseemly scramble for the things which she already possesses.

Among New England cities New Haven has maintained its position of frock-coated dignity and reserve to, perhaps, as great an extent as any. A Chicagoan who happened to alight in a New England city in the middle of the afternoon, and, seeing the streets comparatively deserted, asked where all the people were, to which he received the very suggestive reply, "they are all attending to their

business." The Eastern city is not so "dead" as it appears to the Westerner. Business is going on as usual at the same old stand, but it does not take the citizen so much into the streets by day, nor does his choice of recreations take him out so frequently at night. These two conditions, however, may produce an aggravated state of conservatism. Whether or not New Haven had reached this condition, it is unquestionably true that since her new lighting system has been installed the place has taken on an entirely new air of life. Not only are the people on the streets in the evening, but business men of all kinds seem to have suddenly taken a material interest in each other's welfare and the general upbuilding of the city. The people move about with a quicker pace and more elastic step, and with keener interest manifested in their faces. Their view is broader; there is a decidedly greater tendency to consider the general welfare instead of confining their attention to their own small round of business duties. There is an appreciable air of hospitality about the place; the stranger feels that he is actively welcome, instead of being merely passably accepted. chants of all kinds report a general increase in trade. "Where a man's treasure is, there will his heart be also." merchants are now heart and soul for an extension of the present lighting system. Officials and prominent citizens from other cities and towns are flocking in to see this wonderful system of lighting and the remarkable results which it is accomplishing; and so the benefits of the improvement, like all good works, is spreading out in all directions.

This has been the general experience of all cities and towns which have intelligently used modern decorative street lighting, though the effects may not have been so obvious in all cases; and the same results will follow the similar use of light in any other city or town.

THE EDITOR OF GOOD LIGHTING:

Dear Sir: With reference to article in the March number on the "Hygienic Value of Gas Lighting," your correspondent has proved nothing nor disproved nothing, and his suggestion that further tests be made regarding the hygienic advantages of gas carries but little weight, as it is simply an opinion of one of the small minority who think that electricity has so many advantages over gas. Has gas caused any noticeable failing in the health of its users? The subject has received considerable attention in England, and after most strenuous arguments from the electricians there is even a question as to whether they have convinced themselves to any greater extent than they have either Parliament or the home office.

Your correspondent would confer a

much greater benefit upon humanity if, instead of hairsplitting arguments regarding a test which answers all necessary purposes, he would direct his energies toward ascertaining what good ventilation really is and then proceed to tell us how to obtain it. The medical men have not told us what constitutes good lighting or good ventilation, and such a standard would only be acceptable after considerable constructive work, instead of the "quibbling" and "knocking" tendencies of your electrical correspondent.

Yours very truly, H. Thurston Owens.

TECHNICAL SECTION

SOCIETIES

ILLUMINATING ENGINEERING SOCIETY. In Chicago the section was entertained March 21 by Mr. M. Luckiesh, assistant physicist of the National Electric Lamp Association, Cleveland. This paper, entitled "The Influence of Spectral Character of Light on Effectiveness of Illumination," was very interesting, and followed by much discussion.

Dr. H. E. Ives of the National Electric Lamp Association read a paper before the New York Section, March meeting, on "The Application of Photography to Photometric Problems." After a thorough discussion of his paper Mr. J. E. Sawyer of the Cinemacolor Company talked on the use of light in connection with producing motion pictures in natural colors. Mr. Sawyer brought along with him apparatus, by means of which he showed a number of pictures, including several from foreign countries. There were about 230 members, with their guests, present.

Dr. Ives also read his paper on "The Application of Photography to Photometric Problems" before the Philadelphia Section, Prof. A. L. Rowland gave his

third talk on "Essential Principles of Illumination" under the title "Shades and Redistribution of Light." Dr. C. H. Sharp further entertained the audience with a talk on his observations of European lighting. On April 19 Mr. Elias Goldensky presented a paper on "Artificial Illumination in Portrait Photography." Professor Rowland gave the fourth of his series of talks on "Essential Principles of Illumination." The members of the Professional Association attended this meeting, by special invitation, in good number, altogether making this meeting one of the most interesting which has been held this season.

In Pittsburg the local section on April 12 was addressed by Mr. H. H. Magsdick of the National Electric Lamp Association of Cleveland, on the subject, "Gas, Gasoline, Arc and Incandescent Street Lighting."

Mr. Norman Macbeth read a paper on "Competitive Illuminants from the Standpoint of the Salesman" on March 25 at the New England Section meeting—a subject which was naturally followed by considerable discussion.

CURRENT LITERATURE

New Books

THE ART OF ILLUMINATION, by Louis Bell, Ph. D. \$2.50: McGraw-Hill Book Co., New York, 1912.

This is the second edition of Dr. Bell's book under the above title, first published in 1902. Owing to the remarkable progress made in the manufacture of lamps and accessories, and in illuminating engineering as a science, this second edition, which has been thoroughly revised and enlarged, is practically a new book; the repetition being confined to the necessary historical matter and such principles as were well established some years ago.

A glance at the contents will show the broad manner in which the subject has been treated:

Light and the Eye; Principles of Color; Reflection and Diffusion; Standards of Light and Photometry; The Materials of Illumination—Illuminants of Combustion; The Materials of Illumination—Incandescent Burners; The Electric Incandescent Lamp; The Electric Arc Lamp; Shades and Reflectors; Domestic Illumination; Lighting Large Interiors; Exterior Illumination; Decorative and Scenic Illumination; The Illumination of the Future.

Unlike many books recently published, there is a remarkable freedom from outside references, quotations and footnotes, the text being closely confined to the author's broad experience. The language is clear and simple, without the obtruding mathematical explanations which would be confusing to many who are interested in the subject of lighting.

The chapters on Domestic Illumination, the Lighting of Large Interiors, Exteriors, Decorative and Scenic Illumination particularly are quite out of the ordinary, and contain much that will supply inspiration for the practical illuminating engineer, as well as that larger class interested in good lighting.

NORMAN MACBETH.

LEHRBUCH DER PHOTOMETRIE, Uppenborn-Monasch. Textbook on Photometry by Friedrich Uppenborn and Dr. Berthold Monasch. Published by Druck and Verlag von R. Oldenbourg. Munchen und Berlin. Text is in German. 1912. 420 pp., $6\frac{1}{2}$ x $9\frac{1}{4}$ inches $(4\frac{1}{2}$ x 7 inches).

Much of the material for this book had been collected by Friedrich Uppenborn before his death in 1907. This material has been added to considerably, and was arranged for publication by Dr. Berthold Monasch, the well-known German scientist. On the art of photometry, this book undoubtedly gives the most complete presentation of historical and up-to-date practise available; somewhat over 200 pages are devoted to descriptions of stationary and portable photometers, illuminants and imprints of the visual acuity Ten sections cover the eve from a physiological standpoint, the Perkinje phenomenon—the effects of ultra-violet and infra-red portions of the spectrum; diffuse reflection measurements and characteristics.

Flame standards and electric incandescent working standard lamps are fully covered by nearly forty pages, with many illustrations.

The theory, mathematical formulæ and examples of the calculation of light flux from various sources, together with the different methods for the calculation of total light flux by the Rousseau diagram and the diagrams of Bloch, Kennelly and Wohlauer, also the slide rule of Weinbeer, are taken up in detail.

In the chapter on light distribution as shown by polar curves, practically all the reflector and incandescent electric lamp curves were published by Cravath & Lansingh in the *Electrical World* in 1905. Typical curves of petroleum flame and gas mantle lamp light distributions are given.

Eighteen sections of approximately fifty pages are given to the calculation and measurement of illumination, with

diagrams, tables and equations covering various sources used for interior and for

street illumination.

This book should be very valuable to physicists and photometricians interested in the thorough scientific applications which are so typical of German photometrical practise. Norman Macbeth.

American Items

Free Delivery of Lamp Renewals, by George J. Kirchgasser; Electrical World. March 16.

INTERNATIONAL CANDLE-POWER Measure-MENTS; Elec. World, March 16.

A Variable Absorption Screen for Photo-METRIC USE, AND ITS APPLICATION TO PORTABLE PHOTOMETERS, by Herbert E. Ives; Elec. World, March 16.

OUTDOOR ILLUMINATION FOR A HORSE SHOW;

Elec. World, March 23.

ODD USES FOR ELECTRIC LAMPS; Elec. World,

March 23.

THE EFFECT OF HEIGHT OF SUSPENSION OF LAMPS UPON THE INTENSITY OF ILLUMI-NATION, by W. E. Barrows, Jr.; Elec. World, March 23.

ILLUMINATED CHURCH SIGN; Elec. World,

March 30.

COMPLETION OF ORNAMENTAL CLUSTER POST LIGHTING SYSTEM AT PASCO, WASH.; Elec. World, March 30.

THE NEW SYSTEM OF BOARDWALK LIGHTING AT ATLANTIC CITY; Elec. World, April 6. ILLUMINATION OF BALTIMORE'S AUTOMOBILE

Sноw; Elec. World, April 6.

Tests of Gas and Electric Illumination IN AN AUTOMOBILE FACTORY, by H. S. Magsdick; Elec. World, April 6.

INCANDESCENT LAMPS FOR ELECTRIC VEHICLE

Service; Elec. World, April 6.

LAMP EFFICIENCY; Journal of Electricity, Power and Gas, March 9. CENTRAL STATION MEANS FOR STIMULATING ILLUMINATING ENGINEERING, by Lloyd Garrison; Southern Electrician, April.

COMPARATIVE ADVANTAGES OF GAS AND ELEC-TRICITY FOR LIGHTING, by Albert Scheible;

Southern Electrician, April.

THE USE OF COLOR ON ELECTRIC SIGNS IS BE-COMING POPULAR; Southwestern Electrician, March.

Ornamental Luminous Arc Lighting at New Haven, by C. A. V. Halverson, Jr.; General Electric Review, April.

SIMPLE METHODS OF GOOD LIGHTING, by W. A. Durgin; Electric City Magazine,

March.

SIGNIFICANCE OF ORIGINALITY IN MODERN GAS LIGHTING, Chapters 6 and 7, by F. L Godinez; Progressive Age, March 15 and April 1.

GAS WINDOW LIGHTING, by G. M. Brewer;

Pro. Age, March 15.

Bracet Lighting for Store Fronts; Pro. Age, March 15.

GAS ARCS FOR FACTORY LIGHTING; Pro. Age. March 15.

BALTIMORE INSTALLATIONS AND METHODS: Pro. Age, March 15.

OUTSIDE WINDOW LIGHTING, by A. G. Weldon; Pro. Age, April 1.

CHURCH LIGHTING BY INCANDESCENT GAS LAMPS; American Gas Light Journal, April 1.

AN OBSCURE STREET LIFTED INTO PROMI-NENCE BY GAS ARCS, by A. H. Scott; American Gas Light Journal, April 1.

Boulevard Lighting; Gas Industry, March. RAILROAD STATION LIGHTING; Gas Industry,

March.

WHAT ILLUMINATING ENGINEERING MEANS, by R. F. Pierce; National Commercial Gas Association Bulletin, March.

THE INITIAL STEPS TOWARD INSTALLING OR-NAMENTAL STREET LIGHTS, by L. L. Hopkins; The American City, March.

THE WONDERS OF LIGHT, by J. Gordon Ogden, Nos. 1 and 2; Popular Mechanics, March and April.

DAYLIGHT, by Edward L. Nichols; Journal of the Franklin Institute, April.

THE PRINCIPLES OF INDUSTRIAL LIGHTING, Nos. 1 and 2, by Frank B. Rae, Jr.; Industrial Engineering, March and April.

STATE AND MUNICIPAL REGULATIONS FOR THE QUALITY, DISTRIBUTION AND TESTING OF ILLUMINATING GAS; Circular No. 32 of the Bureau of Standards, Washington.
The Effective Depth of Penetration of

SELENIUM BY LIGHT, by F. C. Brown;

Physical Review, March.

THE NATURE OF LIGHT, by W. P. Face; Chapters 3, 4, 5; Optical Journal and Review, March 14, March 28, April 4. How to Light the Workroom, by H. L. Es-

tep; System, April.

EDITORIALS.

Variable Absorption Screens for Photom-ETRY; Electrical World, March 16.

VARIATION OF ILLUMINATIONS WITH HEIGHT OF SUSPENSION; Electrical World, March 23.

WHAT IS GOOD ILLUMINATION? Electrical Review and Western Electrician, March 16.

USES OF THE ELECTRIC FLASHLIGHT; Electrical Review and Western Electrician, March 16.

ECONOMY IN HOUSEHOLD LAMPS; Journal of Electricity, Power and Gas, March 9.

REFLECTORS AND LIGHT DISTRIBUTION; Southwestern Electrician, March.

THE LIGHTING OF THE CITY CLUB. CHICAGO; Electrical World, March 9.

Foreign Items

COMPILED BY J. S. DOW

ILLUMINATION AND PHOTOMETRY

UEBER DEM EINFLUSS DER UNSYMMETRIE MEHRFLÄMMIGER HÄNGELICHT - AUSEN-LAMPEN, by W. Bertelsmann (*Licht und Lampe*, January 18). The author points out that the polar curve of light distribution is symmetrical in vertical planes for most artificial single units, but that this is not so for multiple unit lamps in many cases. He gives a number of curves illustrating this. (It may be noted that this journal, *Licht und Lampe*, is a new publication, issued fortnightly, in Berlin this year and deals specially with matters connected with illumination.)

Spektrophotometer und Farbenmisch-Apparat, by H. Kruss (Zeit. für Instrumentenkunde, January).

Describes a new form of spectro-photometer with flicker field. The apparatus can also be readily adapted to problems connected with color-mixture and color-matching.

Schnelle Enmittelung der Mittleren Hemisphärischen und Mittleren Spharischen Lichtstärke, by H. Teichmüller (J. f. G., February 24).

In the first part of the article the author gives a review of existing methods of calculating mean spherical candle-power from the polar curve of illuminants, mentioning the methods of Kenelly, Bloch, etc., and giving references to the literature on the subject. He next takes up and analyzes the mechanical slide-rule method of Weinbeer and finally describes a device of this kind which he himself has constructed and which is said to have several distinct advantages.

Some Modern Problems in Illumination, by T. Thorn Baker (Paper read before the Royal Society of Arts March 6. Somewhat similar ground is covered in an article in the *Times* Engineering Supplement, February 28; the paper is also abstracted in various journals, the official account being in the *Journal of the Royal Society of Arts*, March 8).

The author deals mainly with color problems, comparing the spectra from the mercury vapor lamp and of the neon, helium and nitrogen tubes. Reference is also made to the use of screens with tungsten lamps to produce artificial daylight. Some interesting particulars are given of the effect of colored light on bacteria (on which the ultra-violet and orange rays have a marked influence, but the intermediate yellow-green region is relatively inactive).

THE ANNUAL DINNER OF THE ILLUMINATING ENGINEERING SOCIETY (*Illum. Eng.*, London, March).

The official account of the speeches. Prof. S. P. Thompson presided and Dr. R. S. Clay, of the Northern Polytechnic, proposed the toast of the Illuminating Engineering Society.

Among others who spoke were Dr. W. Garnett, educational adviser to the L. C. C.; Dr. F. G. Kenyon, chief librarian at the British Museum; Mr. R. G. Shadbolt, president of the Institution of Gas Engineers, and Mr. W. Mordey, past president of the Institution of Electrical Engineers. All wished

success to the society and agreed as to its great sphere of usefulness.

Lectures on Illuminating Engineering (Illum. Eng., London, March; J. G. L., January 30, February 6, 13, 20).

Summary of the lectures on illuminating engineering being delivered at three separate institutions in London. The Journal of Gaslighting has a complete account of the series of six delivered by Mr. Dow at the Regent Street Polytechnic, photometry, shades and reflectors, color and practical problems in illumination being all dealt with. Dekoration von Schaufenstern mit Be-

LEUCHTUNGSKÖRPERN (Licht und Lampe, January 18).

Points out the decorative uses of large hanging chandeliers in shop window lighting.

DIE HYGIENE DER BELEUCHTUNG, by G. Zehden (Licht und Lampe, January 18).

ON OPAL SHADES (Elec. Review, February

16).

ELECTRIC LIGHTING

DER QUECKSILBERBOGEN MIT WEISSEM LICHT, by E. Darmois and M. Leblanc (Z. f. B., February 20).

A review of various methods of improving the color of mercury lamps—e. g., by inserting gases or metals in the tube, giving red spectrum lines; by combining the tube with carbon filament lamps, etc., all of which are more or less unsatisfactory. The new rhodamine reflector, transforming a portion of the blue light into red rays, seems a more hopeful solution.

ELECTRIC LIGHTING OF STREETS HAVING VERANDAS, by E. Kilburn Scott (Illum. Eng., London, March).

Discusses the special problem of lighting streets having veranda coverings to the pavements, as met with in various cities in Australia. Tubular lights might sometimes be advantageously employed in the wider streets, local lighting of this kind being combined with central general lighting.

SHOPLIGHTING BY ELECTRICITY, by N. W. Prangnell (Paper read before the Illuminating Engineering Society, London, February 20; *Illum. Eng.*, London, March).

The author presents a considerable number of photographs and sketches showing methods of electrical shoplighting. Some of these utilize concealed lighting and "reflector-signs," by which the actual filament is screened from the eyes of those outside the window, but a certain amount of light reflected inwards on the goods, are coming into favor. Some types of indirect units are shown and the merits of the system of lighting are discussed. A distinction is drawn between the display-lighting of the window and the illumination of the interior of the shop. Owing to the variations met with in different districts it is difficult to fix any

standard at present. For example, in various jeweler's shops the illumination on the counters varied from 6 to 16 foot-candles and in drapers from 2 to 8 foot-candles, and yet in all cases the merchants professed themselves content.

STREET LIGHTING AT WATFORD (Electrician,

February 16).

THE OVERSHOOTING OF METALLIC FILAMENT Lamps (Electrician, January 12, 16; February 2).

FORTSCHRITTE IN DER GLÜHLAMPENTECHNIK

(Z. f. B., January 30).

CONSTRUCTION AND CHARACTERISTICS OF THE NEON LAMP (Elec. Rev., February 9).

GAS, OIL, ACETYLENE LIGHTING, ETC.

BLACKENED CEILINGS, by P. Blagg (G. W.,

February 24). Suggests that the blackening of ceilings where artificial light is used is often due to upward currents of air, which deposit the dust from the room, and mentions cases in which this occurs with electric lighting as well as gas.

Shop Lighting by Gas, by A. E. Broadberry (Paper read before the Illuminating Engineering Society, London, February 20;

Illum. Eng., London, March).

The paper contains a considerable number of photographs of gas lighted shops, some using powerful outside lamps, others lighted internally. An interesting point is the use of high pressure gas outside lamps. A great variety of tables is also presented showing the order of illumination secured by various arrangements of lamps. The illumination is in some cases very high, rising, in some instances, to 80 foot-candles.

GRANJON, LES NOUVEAUTÈS DE L'ANNÈE (Acetylene) (Rev. des Eclairages, Janu-

uary 30).

A useful summary of novelties in acetylene lighting during the past years. These include various types of hand lamps, the use of the oxy-acetylene flame with a pellet of rare earth for lantern and projection work, and the use of a new substance, "catalysol," which has the power of absorbing phosphoretted hydrogen.

UEBER LICHTMASTE FÜR PRESSLUFTLAMPEN,

by H. Wunderlich (J. f. G., February 24). Discusses the design of lamp-posts for high candle-power lamps, special reference being made to the special difficulties in connection with raising and lowering apparatus for high pressure air lamps.

Zur Geschichte des Gasglühlichts ($Z.\ f.$

B., February 10, 20).
THE "STRAND" MANTLE AND ITS PRODUC-TION (J. G. L., January 30; G. W., February 10).

THE PINTSCH HIGH PRESSURE SYSTEM (J. G.

L., February 6).
"BLANLITE" HIGH POWER LAMPS (G. W., February 3).

Design of Decorative Lamp-posts (G. W.

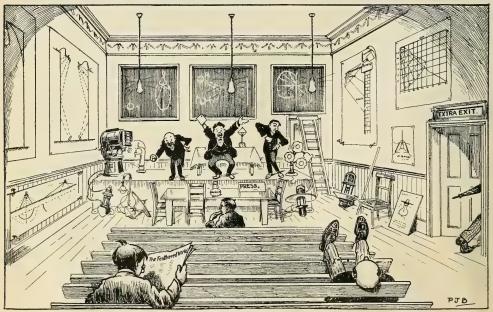
February 3).

UEBER DIE FORTSCHRITTE AUF DEM GEBIETE DER Spiritusbeleuchtung (Licht und Lampe, January 18).

Contractions used: E. T. Z. Elektrotechnische Zeitschrift. G. W. Gas World. Illum. Eng. Lond. Illuminating Engineer (Lon-J. f. G.Journal für Gasbeleuchtung und Was-

serversorgung. J. G. L. Journal of Gaslighting. Z. f. B. Zeitschrift für Beleuchtungswesen.

From One of Our English Contemporaries



From " Electrical Industries," London.

[&]quot;EDUCATING THE ELECTRICAL CONTRACTOR IN THE SCIENCE AND ART OF ILLUMINATION."

IN THE PATH OF PROGRESS

"Moonstone"—the Latest in Artistic and Efficient Lighting Glassware

The Jefferson Glass Co., Follansbee, W. Va., has presented a glassware of translucent character under the trade name of Moonstone. Like the moonstone, these shades and reflectors show just the faintest tint of the blue. They are of uniform character of material, and a high degree of efficiency is claimed for them. There are no specks. Furthermore, it is announced that Moonstone shades and reflectors will be obtainable in both the Sheffield and Doric styles.

Kopp's "Havana"

Under the new management of the Pittsburgh Lamp, Brass and Glass Co., Pittsburgh, Pa., announcement of a new character of glassware is made under the trade name of "Havana." This glassware is the development of Nicholas Kopp, who has long been identified with this company. Havana globes and shades are especially designed to offer a rich, golden brown in daylight and a mellow glow at night. They are made up in Grecian designs for both gas and electric lighting. This company has under way a full line of high efficiency illuminating glassware which is known as Translux. Full information regarding these new lines of glassware can be secured from the Pittsburgh or any of the several branch offices of the company.

"Cora" Glass

The above is the trade name given to a new line of illuminating glassware now on the market, produced by the Consolidated Lamp, Brass & Glass Co., of Coraopolis, Pa. This line includes the well recognized shapes in shades and reflectors, ornate dishes, bowls, etc. Cora glassware is of a pure white character, clear, and appears rather more than ordinarily highly finished.

Cora, it is reported, as a name, has met with favor as a good one, inasmuch as no one could ever forget "Cora," and it evidently identifies in one's mind the Pennsylvania town, Coraopolis, where the glass is made.

New Process for Gilding

A new process for preparing wood and plaster, of special interest to fixture manufacturers and dealers, is being introduced by the J. Adler Gilding Company, Inc., New York. In explanation, it is stated that when a fixture made in wood is sent for gilding it usually receives a coat of glue size first, and a few coats of whitening after. In all, these two materials contain over 50 per cent. water. A certain amount of this is inevitably absorbed by the wood, with the result that there is sure to be warping, cracking, etc.; this may not appear immediately, but it is likely to occur eventually, after the job is finished. As the wood dries it will contract.

In regard to plaster, it is well known that when it is poured the glue moulds are greased so as not to allow the plaster to adhere. Ordinarily, it is claimed, the plaster retains some of the lubricant which causes trouble-and peels off the gilding after the job is finished, no matter how thoroughly the surface is The Adler gilding process is cleaned. designed not only to serve the purpose of whitening, but to absolutely close the pores of the wood, forming a hard skin on its surface, and preventing trouble. The same composition, when applied to plaster, has a tendency to dissolve the grease, binds with it and penetrates the pores of the plaster enough to protect it in the same way as in the case of wood.



THE NEW "BEAU IDEAL GAS ARC."

Another New Gas Arc Lamp

Particular attention is paid, it is claimed, by the National Gas Light Company, Kalamazoo, Mich., to attractiveness of design in its new "Beau Ideal Gas Arc." Furthermore, but not secondary, they claim for this new gas arc a general higher efficiency than any gas arc previously produced. Contention is made that the "Beau Ideal Gas Arc" is "built on curves rather than straight lines," giving special attention to the globe, which is relatively large.

It is further claimed that this lamp requires very low cost in maintenance—is simple in construction and operation.

A Demonstration of Mazda Lamp Ruggedness

The following incident happening recently in the city of Warren, serves to demonstrate the sturdiness of street series Mazda lamps with drawn wire filaments:

A runaway horse attached to a heavy carriage ran into one of the lighting standards that within the past year have been installed along the streets of that city. The vehicle struck the standard with such force that the three globes inclosing the lamps were shattered. The wagon hooked into the post, and was stopped while the horse broke loose on account of the crossbar breaking. It was found afterward that not one of the three lamps on the standard were injured, in

spite of the fact that the accident occurred about three o'clock in the afternoon when the lamps were not burning.

A Weatherproof Industrial Lighting Unit of Unique Design

The development laboratories of the Tungstolier Company, Cleveland, Ohio, recently completed a very unique weatherproof unit for industrial and commercial service, which will be placed upon the market within a few weeks. In this design two things were sought-a unit that should be absolutely weatherproof and of the sturdy construction demanded in an exposed fixture; and, interchangeability which would permit the central station or contractor to meet any reasonable requirement without the necessity either of carrying a large stock or being compelled to wait upon the factory shipment. This latter feature is characteristic of practically all of the Tungstolier Company's product. convenience, economy, and service to the middleman being considered of equal importance with the requirements of the final user.

This unit is available in a variety of practical styles for different classes of service, such as warehouses, foundries, machine shops, storerooms, freight platforms, yards, store fronts, etc. The desirable feature from the standpoint of the trade is that the units can be adapted to different service conditions by the use of standard material, thus decreasing the amount of stock necessary to meet a normal diversity of demand. Chain suspension, pipe suspension, ceiling types and bracket support are all shown in the new Bulletin, No. 130.

Thos. Dolan Resigns as President of the United Gas Improvement Company

At a recent meeting of the Board of Directors of the United Gas Improvement Company, Thomas Dolan resigned, and in his place Samuel T. Bodine, formerly first vice-president, was elected president. Randall Morgan, Walton Clark, and Lewis Lillie were, in turn, "moved up one" as first, second, and third vice-presidents, respectively. A new office, fifth vice-president, was created, and Paul

Thompson, who was formerly assistant to the second vice-president, was elected to this position. Mr. George W. Curran, formerly comptroller, was elected secretary. Rollin Norris, who has been superintendent of works, was promoted to the position of general superintendent; J. A. P. Crisfield, formerly engineer of construction, was elected engineer, and W. H. Marshall, until recently assistant secretary, will be assistant to the third vice-president. W. F. Douthirt, formerly secretary, will be fourth vice-president. The chairman of the Board of Directors will be Thomas Dolan, as heretofore.

H. W. Johns-Manville Co. Moves

Somewhat more than ordinary interest is attached to the change of headquarters of H. W. Johns-Manville Co., manufacturers of asbestos, magnesia and electrical supplies. This company has moved into its new building at Madison Avenue and Forty-first Street, New York, from their old quarters at 100 William Street.

This move marks the fifty-fourth anniversary of the company, which, as it now stands, is the combination of various organizations which have been identified with progress in their several lines.

In its new quarters the company is to be congratulated on its having a fine building of its own, and one particularly well arranged for its requirements. The building is twelve stories high, with offices for the several departments and innumerable employees. The enlarged facilities are important for two reasons: First, the necessity for accommodating an increasing force of employees, and the other to enable the company to better exhibit a much larger and more complete stock of goods than heretofore.

Paint Manufacturers "Waking Up"

A pleasant and instructive little booklet under the title, "More Light," tells a good story of the importance of using the right kind of paint for giving "more light" for interiors generally. To quote a bit, this booklet says: "The manufacturer who uses Rice's Mill White increases the direct sales of his product because his plant is made so light, sanitary, and clean that it creates an instantaneous and favorable impression in the minds of visiting buyers who are shown through it.

"He saves space that would be dark,

except for this light-diffusing paint.

"He saves in an improvement—slight, perhaps, but there—of the quality of his product.

"He saves in an increased working

efficiency of his employees."

It is high time, indeed, that illuminating engineers, architects, and manufacturers should appreciate the importance of an increased illumination produced by proper treatment of the interior walls, both as regards natural and artificial illumination. The only criticism that can be brought against this booklet, produced by the United States Gutta Percha Paint Company, Providence, R. I., is that it is too general, too purely commercial; it does not, however, give any specific information as up-to-date illuminating engineers and architects require.

New Publications

A Bulletin of Engineering Research, No. 101, entitled "Lamp Efficiency," issued by the Engineering Department of the National Quality Lamp Division of General Electric Company, Cleveland, Ohio, discusses the factors involved in the operation of incandescent lamps for a minimum cost of light. An analysis of the cost of light, factors controlling the cost of light (cost of energy and cost of lamps), the determination of the operating condiditions under which a given type and size of lamp will produce light most economically and the approximate method of computing the best efficiency are given a detailed treatment. The subject is taken up in an analytical method and illustrated by a large number of curves showing lamp performance.

This bulletin, the first number of a series of bulletins on engineering research, which will be devoted to scientific discussion of various problems bearing upon the manufacture and use of incandescent lamps, will be of interest to the central station man, and, in fact, to any one interested in the economic production of light by means of incandescent lamps. Copies

may be had by addressing the Engineering Department above mentioned.

The H. W. Johns-Manville Company has just produced a booklet of unusual interest and value on the I. P. Frink specialties for illumination of banks, insurance companies, etc. This booklet provides data for the illuminating engineer, designed to show the advantages of the Frink special reflectors when properly designed in acordance with engineering and architectural requirements. It presents several illustrations, with a description of just how each one was treated, with the announcement that the engineering department of the H. W. Johns-Manville Company is prepared to undertake all kinds of installations of this order. Particular attention has been paid to line diagrams, which make the booklet a distinct addition to the literature on illuminating engineering.

The Fixtureman is a new organ just being issued by the Tungstolier Company, of Conneaut, Ohio. It is devoted chiefly to business hints for the electrical contractor who handles fixtures and for the central station man with a wiring and equipment department, as well as for the dealer who handles fixtures exclusively. The keynote of this little periodical is found in an announcement of recent Tungstolier publications, in which the ad. man says: "It is our idea that the trade wants co-operation rather than solicita-The publications we issue are designed to help the fixtureman sell goods, not simply to tell him where to buy goods."

The Fixtureman is frankly patterned after the Philistine magazine. Enough illustrations and items in lighter vein are scattered through its pages to hold the interest of the casual reader, while the sound business-building articles are of practical benefit and value to those more seriously inclined. While no subscription price is charged, because The Fixtureman is, in effect, a house organ, the circulation is necessarily very closely restricted to those who are actively interested in the development of fixture business.

As very generally known throughout the lighting field, the Benjamin Electric Manufacturing Company, Chicago, have been keen to appreciate the importance of providing electric lighting fixtures and accessories to meet the fast arising requirements as they develop. Their latest booklet and catalogue of their various products is entitled Bulletin No. 10. Any one who reviews this booklet and cannot find satisfactory appliances for properly illuminating an industrial plant would certainly seem to be lacking in the ability to make up his mind. Particular care is taken to give specific information, together with photometric data, to show just what to expect of the various reflectors available—for big units, small units, and clusters.

"Make your lighting installation different, original, and attractive. Only the thing that's 'different' attracts. Here's where Opalux 'shines.' Opalux products are different."

With these words the latest booklet of the Opalux Company, New York, introduces a brief but direct analysis of the advantages of its several lines of shades and reflectors. The booklet carries with it the Opalux slogan, "The glass without the glare." As a piece of condensed literature containing illustrations of reflectors and commercial data the booklet unusually well serves its purpose.

Personal

Mr. Manfred A. Pakas, formerly associated with the Flour City Ornamental Iron Works, has organized a company, with headquarters in Plymouth Building, Minneapolis, Minn., for representing as Western agent the Gardiner Paint Company of New York. Gardiner's paint is claimed to be valuable for its anti-rust properties, and at the same time a preventive of electrolysis. It is used in connection with lamp-post installations in some of the largest cities of the United States.

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AND THE ILLUMINATING ENGINEER

E. S. STRUNK, Managing Editor.

H. RIDDELL, Advertising Manager.

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The Lighting of Seattle

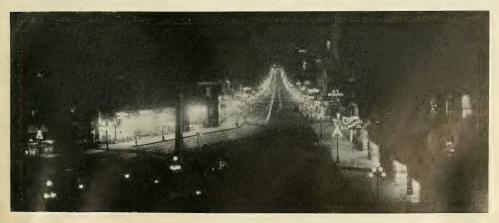
The "White Ways" of the Metropolis of the Northwest

By W. J. GRAMBS

During the years 1907 to 1911 the business district of Seattle was so altered by re-grades and new buildings as to be almost entirely remade, and with the general improvement came a demand for better street lighting than was given by the inclosed series arc lamps then in use. Some system was sought which would give a sufficient illumination evenly distributed over the street, and at the same time be handsome in appearance both by day and by night. A few cities in America had experimented with ornamental iron cluster light poles, and it was believed that a properly designed system of that type would be most suitable. Accordingly, the City Council passed an ordinance directing that plans and esti-

mates be furnished for installing such a system on Third Avenue, which had just been cut through the hills and made into a business street.

When the work of designing was started in the offices of the municipal lighting department, a careful comparison was made of all poles in use on which data could be obtained, noting the appearance of the pole by night and by day, the weight and cost of the castings, and especially the distribution of light secured. In the end the conclusion was reached that a new design might be made which would more nearly meet the needs in Seattle than any of the poles so far examined. The pole finally adopted was selected from a large number of designs drawn by the de-



FIRST AVENUE, SEATTLE, LOOKING NORTH. ONE OF SEATTLE'S WHITE WAYS.



SECOND AVENUE, SEATTLE, LOOKING NORTH. .

partment, and more or less similar in type. A complete system of underground distribution was designed to serve the poles, and the first poles were installed on Third Avenue. Immediately on the completion of this work the property owners along other streets in the vicinity petitioned for the same improvement, and the system was rapidly extended until in 1911 there were over 25 miles of street improved with cluster lights.

The poles used in the business district of Seattle are placed just inside the curb on opposite sides of the street, and carry five globes each, the lowest being 11 feet above the sidewalk. The most noticeable feature is the unique arrangement of the lamps, which are placed in a triangle perpendicular to the curb line, with a 10-inch globe at the apex of the triangle, two upright 14-inch globes just below and two pendant 12-inch globes at the lower corners of the triangle. This arrangement permits the globes to be spaced evenly,

and gives a uniform distribution of light of lower unit intensity at the source for the same light on the street than any other arrangement available, and makes a most pleasing appearance both at night and in the daytime. The pole itself is of simple design, and is as light as could be made with the necessary strength, weighing altogether about 750 pounds. The pole proper is cast separate from the crossarms, which fit onto the top of the shaft. Very little ornament is placed on the pole itself, and the simple design harmonizes well with any surroundings, and is less expensive to make.

When the new lighting system was designed the tungsten lamp had just been introduced, and it was believed that a low-voltage tungsten lamp might be made which would be ideal for cluster lights. Accordingly a space was provided in the base of each pole for a small low-voltage transformer and a request for such a lamp was sent to the manufacturers. After



THIRD AVENUE, LOOKING NORTH.

some time the General Electric Company made up a few eight-volt tungsten lamps and sent them on for trial. They proved so satisfactory that more were ordered immediately, and the 110-volt lamps which had been installed were replaced as rapidly as possible with the new lamps, thus carrying out the original plans. This low-voltage lamp, which has since been made

standard and found wide use, takes 6.6 amperes at 7.6 volts, consuming 50 watts, and gives about 40 candle-power. The lamps are mounted so that the filament comes in the center of the globe, being upright in the upright globes and pendant in the hanging globes. The globes themselves have a light sand-blast finish inside and have proved very satisfactory, giving



WESTLAKE BOULEVARD, LOOKING NORTH FROM PIKE STREET.



THE SEATTLE ELECTRIC COMPANY'S SIGN,
EIGHTY FEET LONG BY SEVENTY
FEET HIGH.

good diffusion with very little loss of light. Each globe has a small hole opposite the mouth, to drain the water from it and prevent dust and insects from accumulating.

The system is fed from 2500-volt

mains, which are carried in vitrified clay duct, with the commercial feeders. Manholes containing 5 and 10-kilowatt transformers are placed about 800 feet apart under the sidewalk at street corners. Manholes are 8 feet square and have 8inch concrete walls and floor, and are drained into the sewer. Twenty-fivehundred-volt feeders run between manholes in fiber duct cased in conduit placed under the sidewalk or in the parking strip, and are of No. 4 duplex lead-covered cable, with varnished cloth insulation. From the manhole transformers secondaries of No. 6 and No. 8 rubber-covered wire encased in lead feed the small transformers in the base of the poles. The secondaries form a 250-125-volt, three-wire system, and poles are tapped from alternate sides of this bus with No. 8 duplex cable. A concrete hand-hole is placed in the sidewalk to serve two or three poles. The pole-base transformers are air-cooled, of 250 watts capacity, with a ratio of 125 to 8 volts, and were made in the shops of the lighting department. From this transformer No. 4 rubber-covered wire runs up



/.OREGON-WASHINGTON RAILWAY & NAVIGATION COMPANY TERMINAL, SEATTLE.

inside the pole to the lamps. In designing the cluster lights the cost of maintenance was carefully considered, and the resulting system is economical to maintain and operate. Every part of the system is as durable as could be made, with the idea of keeping depreciation as low as possible.

The spacing between poles varies some with the length of the block, but averages from 85 to 100 feet. With this spacing on a 90-foot street, using five 50-watt lamps per pole, an illumination is secured at the center of the street varying in intensity from 0.34 to 0.45 foot-candles, and on the sidewalk from 0.32 to 0.79 foot-candles. The photographs give a fair idea of appearance of the system, both by night and by day. There are in Seattle 1,116 five-globe poles, lighting about thirteen and one-half miles of street.

In residence districts where a lower illumination is sufficient, a three-globe pole is used, similar to the five-globe pole with the lower globes removed. These poles carry three 50-watt lamps of the type already described, and have a transformer in the base of the pole. The spacing is varied to suit conditions, and runs from 150 to 200 feet.

In some places the three-globe poles are "staggered" on opposite sides of the street. The manholes and distributing system are similar to those described above except that the cables are lighter and manholes further apart.

Along driveways and in parks a pole is used, which carries a single 20-inch globe with a 75-watt, 12½-volt lamp. These poles are placed at the corners, and in the middle of 400-foot blocks and similar spacing is used on blocks of different lengths. In all there are 378 three-globe poles lighting 8½ miles of street, and 137 one-globe poles lighting 3 miles of street. With the 13½ miles lighted by five-globe poles, the total of streets improved with cluster lights reaches 25 miles.

The value of a cluster lighting system lies not only in the even illumination secured, but also in the decorative effect it produces by night and the ornamental appearance of the poles by day.

In Seattle the best possible system was sought with due regard for economy, and on this system more than any other one thing is based Seattle's claim to be "the best lighted city in America."

Good Lighting a Necessity in Industrial Plants

Some Points to be Considered When Laying Out Factory Lighting Installations

By G. H. STICKNEY

A well-lighted plant is generally a paying plant. To be sure the question of lighting may be the deciding factor between a profitable business and a losing business, but this statement means more than that. Good lighting goes with business initiative and clean, healthful shops. This was not necessarily true a generation ago, but we have learned some very important facts in the last few years, and we follow entirely different methods.

Compare the modern factory with one built, say, even ten years ago. Outside of its greater magnitude and complexity we notice some very decided changes in the architectural construction. Windows have taken the place of solid walls, and

high ceilings the place of low ones. This is a tribute to the appreciation of the value of daylight.

Unfortunately, we cannot always have daylight when and where we will. A generation ago all activity ceased with the setting sun; to-day we substitute the feeble, though remarkably effective substitute—artificial light. During the busy winter season of long nights and short days artificial light enables the factory to run full hours. Many modern processes, either on account of their very nature, or on account of enormous investment involved, need to be carried on continuously, and here again artificial lighting is necessary. All these circumstance, he

acted back and forth, and the very progress which has resulted from the improved artificial lighting has demanded further improvements which have been forthcom-

ıng.

The recent developments in lighting units have surpassed those of almost any other field of activity. Artificial lighting is as old as history, but the past fifty years have witnessed greater advances than all the preceding centuries, and even the past five or ten years have brought forth gains of 100 to 300 per cent. from the light obtainable from a given amount of energy.

As would be expected, a study of commercial lighting will show that this field has been revolutionized, and a similar investigation of mill and factory lighting will show that industrial lighting is being

revolutionized.

It seems almost superfluous to say that a workman can do more work and better work under good illumination than under poor; that he is less liable to do defective work, thus wasting not only his time and effort, but his material. The difference in this respect is far greater even than would appear on the surface. It involves not only the effectiveness of the illumination but the mental and physical strain of the day's work and as well as the workman's whole attitude toward his work.

Then there is the question of accidents; available figures prove conclusively that accidents are more likely to occur under poor illumination.* Accidents mean interrupted and delayed production, perhaps injured machinery or buildings and, worst of all, physical injury and loss of life. Outside of the moral obligation involved in accidents to employees, there is a serious financial question of the legal result. Inadequate lighting may be considered by a jury as contributory negligence on the part of the employer. Public opinion is becoming more and more aroused to the demands for suitable working conditions for employees, and unless manufacturers anticipate and provide for these conditions they may be compelled to make such provision after the settlement of disastrous damage suits. But, eliminating the question of accidents, it pays to provide good illumination. It is not much to ask for such illumination to save, say, five or ten minutes of a workingman's day, and yet figures taken in a number of representative plants, show that the cost of lighting for eight hours is not greater than the cost of five minutes' time of the workmen benefited. We are inclined to think of lighting as an expensive luxury, but such figures as these, and they will ordinarily hold, would indicate that it is an economic necessity.

Certain of the large steel manufacturing companies of the country have apparently anticipated such conditions; they have made a more thorough and practical investigation of what constitutes good illumination for their purposes, and how such illumination can be produced, than any other light users. And it is apparent from the radical improvements recently made in their lighting equipments that they have found it good business to provide good and effective illumination.

If good lighting is so important it is necessary that we come to some understanding as to just what constitutes good lighting. This is not so easy to define as it might seem. What is apparently suited for one process of manufacturing may be worse than useless for another. What may appear pleasing at first sight may be decidedly uncomfortable after an hour's close application. The popular method of judging a light is very misleading. We often see an inexperienced critic who looks at a number of lamps in a row and chooses the one making the most brilliant appearance. A showroom is the poorest place to judge the effectiveness of a light, and the glare one of the poorest measures of that quality. A light should be judged by the objects illuminated rather than by its brilliant appearance. The phrase "Light on the work and not in the eves" expresses the gist of the matter.

Lighting requires intensity sufficient to see objects clearly and without effort. As far as possible glare, dense shadows and harsh contrasts should be avoided. Steadiness, proper direction, correct distribution and reliability are all important attributes of good lighting. Economy is always a consideration in industrial lighting, and, while it is frequently over-emphasized, it never should be entirely neglected. Mod-

Jalder's paper before American Society ical Engineers, New York, Feb. 14.

ern methods of cost accounting, especially when applied so as to indicate production advantages, are important incentives to the adoption of modern lighting methods, even at the sacrifice of operative apparatus. Cost comparisons will frequently show an actual saving with improved illumination for modern lighting apparatus. However, the average factory, in which the lighting was designed several years ago, is far below the good practise of to-day, so that improvement in lighting effect should be sought before saving in cost.

Lighting units should be capable of producing suitable intensity, and so equipped as to distribute the light effectively where needed. They should be convenient of control and simple of maintenance, and with reasonable attention should not be seriously affected in their operation or efficiency by the presence of dust, smoke or fumes, if they are to be installed where they will be subject to such action.

Even in installations where lamps were supposed to be receiving reasonable care, tests have shown that all the way from 30 per cent. to 50 per cent. of the light was being wasted by accumulations of dust and dirt. It is desirable wherever possible to institute a systematic arrangement for cleaning glassware and reflecting surfaces, at regular periods, depending upon the extent to which they are exposed to such accumulations.

It is possible to classify the different methods of lighting a workroom into four different classes: general illumination, localized illumination, combined and localized illumination and localized general illumination. General illumination and localized illumination mark the two extremes of practise. With the former, which implies the use of high power units, an even illumination throughout the room,

independent of the arrangement of the processes and machinery, is approximated. With the latter, which implies low-power units, light is localized just where needed. the stray light being depended upon to see in getting around. With the combined system a low general illumination is supplemented by higher intensity localized lighting, at special points and perhaps only at special times. Localized general illumination, as a practise, has followed the recent developments of efficient lamps of various intermediate powers. term is applied to a general illumination plan with regard to the arrangement of machinery or processes, so that, instead of trying to attain an equal illumination throughout the room, the lamps are so spaced as to produce, at important points, an intensity higher than the average.

No one of these systems meets all conditions of industrial lighting, and each of them meets certain conditions better than any of the others. In the majority of the installations the choice of system is not easily made, since there are two or more, any one of which is capable of giving good The selection of a system for particular installation depends upon the type of building, processes to be lighted, and many special or local conditions. The merits of these various systems and the conditions under which each is applicable have been discussed in several technical articles and need not be commented upon here. No simple general rules can be formulated which will be applicable to all cases. While considerable data has been published by lamp and reflector manufacturers, it is desirable in planning the lighting of a large plant to consult an experienced engineer familiar with the latest practise of industrial lighting and the requirements and conditions to be met.

What Does a Photograph Tell?

By Norman Macbeth

A photograph may be more effective in carrying a point with the uninitiated than would be possible through a visit to the actual installation. It should not be overlooked, however, that photographic processes may be used to tell almost any story the manipulator desires. Because it is a photograph, it is not necessarily true. In a court case which came up some time ago, in fixing the damages due to elevating a roadway over railway tracks, the owner of the property presented photographic evidence to prove that the ground floor of his residence was now so far below the street level that it would be necessary to rebuild with the first floor level at the height which had formerly been the second floor, and as a consequence the damages should be sufficient to furnish him with a new house. The attorney for the railroad also submitted photographic evidence with the opposite conclusion—that the grade elevation was not higher than the first floor level of the house, as it had stood in relation to the roadway prior to the change. On examination, the owner confessed that his photograph had been taken from the ditch on the opposite side of the road with the camera on the ground—a kind of "worm's eye" view, whereas the photographer for the railroad had placed his camera on a tall step-ladder, so that his view pictured the roadway in the foreground on the same level as before any

change had been made.

The well-worn, much-abused qualification "this photograph was made from an unretouched negative" is generally thrust forward with the idea that "now the cards are all on the table," whereas the very opposite condition may be true. A photograph may be made to tell almost any story desired, and should only be used when fully qualified, and with the assurance given, that the picture submitted is a fair representation of the conditions as they would appear to the eve of the observer. Exaggerated or unduly brilliant photographs, if they mislead in attributing higher intensities of illumination, and consequently a greater light output to the lamps used, are just as dishonest as any other misstatement of fact. They belong to the "2000 candle-power arc lamp' rating class.

Undoubtedly many photographs of this







FIG. I.





FIG. 2.

kind have been circulated in ignorance or thoughtlessness, or with the idea that good advertising copy need not be true. We constantly see photographs of street lighting installations which in apparent brightness and uniformity put the daylight views far into the background. This is largely true of interior photographs also, although less at this time than when enclosed arc lamps and similar sources were more generally used. These lamps generate light having an abundance of those wave lengths which may be invisible to the eye, but which act rapidly on the Of the ordinary photographic plate. sources in use at the present time, the enclosed arc lamps, particularly the high voltage arcs, the metallic flame luminous arcs, the white flame carbon arc lamps, the mercury vapor lamps, and the quartz mercury lamps should only be photographed in installations when the proper light-absorbing filter is used on the camera. These filters or absorbing screens are usually yellow, but should be chosen to fit the kind of plate or film used, that the plate may have the same distribution of color sensitiveness as the eye.

The ordinary photographic plate is intensely sensitive to ultra-violet, violet and blue, and is comparatively insensible to yellow, a color which is much more luminous to the eye. The peak of the luminosity curve of the eye comes in the yellow-green portion of the spectrum, to which the plate is but slightly sensitive. Orthochromatic films and plates are somewhat corrected for this difficulty, and are more sensitive over a wider range of colors.

In explaining the action of the eye fre-

quent reference in the past has been made to the camera—the lens, the diaphragm or stop, and the plate have been used to explain the lens action of the eye, the pupil and the retina, and it has even been stated that glare in the eye is analogous to halation on a plate, but a short step to the further assumption that where halation is not shown, glare would not be present.

There is a resemblance in the eye to a photographic camera and lens, however; the crystalline lens, with its perfect iris diaphragm, the pupil, forms the optical image which is projected on the retina at the back of the eye, corresponding in position to the sensitive plate. Only the front part of the eye as a physical or optical instrument may be compared to a camera; the retina and the optic nerve which conveys the impressions to the brain are purely physiological.

The eye makes a note of the exact outline of an object and the different lights and shades reflected from the object, so does the camera, with the one important difference—the record of the eye is the same for a second or a minute. The record on the plate depends not only upon the intensity and color of the light reflected to it, but also upon the time the light is allowed to act.

An exposure of one second may be sufficient in photographing a sheet of white paper, and also a sheet of gray paper, and with the plate properly developed the positive print will show the difference between the papers. If, however, the white paper had been given one second exposure, with three or four seconds for the gray, the resulting negatives would fail to show

the difference between the two papers.

Fig. 1 is a night photograph of a building illuminated to a comparatively low intensity by a single enclosed arc lamp on the opposite corner of the street. In this case the light was of fairly high actinic value, and while the illumination was not sufficient for the eye to more than define the main outlines of the structure, the camera brought out the detail in an excellent manner. This location is in Florida, and the time March, so that the foreground, while appearing very light, was not snow covered. This picture was large-

ly a matter of violet and blue light, together with length of exposure.

Detail in a picture is influenced by time of exposure, by light, depending upon intensity and wave length, by diaphragm of lens, character of subject, and the speed of the plate. Plate speed may easily vary from one to twenty, *i. e.*, an exposure of one second may be sufficient under certain conditions, with an extra rapid plate, when 20 seconds would be required with a very slow plate—all other conditions being equal, to effect the same change in the plates on similar development. With













the lens diaphragms or stops from F/4 to F/45 the relative areas of lens openings are as I is to 128. So that two photographs of the same subject under exactly similar conditions of light intensity and wave length, with the same camera, with plates of equal size, would be similarly exposed in one second, with an extra rapid plate and a lens working at F/4, as in 2000 seconds, or 34 minutes, with a slow plate and a lens working at F/45. Likewise an exposure of two minutes with a fast plate and an F/4 lens, would result in an equivalent exposure under exactly similar daylight conditions, with the slow plate and the lens stopped down to F/45 in 68 hours, allowing exposures of eight or ten hours per day; this period would extend over one week, including two Sundays.

In view of the above what possible information would be conveyed by the statement that a particular photograph under artificial illumination was the result of five minutes' exposure when another was given fifty minutes. In the latter case the illumination might easily be several times as brilliant as in the five-minute exposure and be generally more satisfactory.

To state, therefore, that a certain photograph was secured with an exposure of so many minutes without a clear statement of lens opening and plate used is to tell a very small part of the story.

Then again an intensity of one-tenth foot-candle, with an abundance of violet and similar short, invisible wave lengths, may act more rapidly than an intensity of 10 foot-candles from a yellow flame carbon arc lamp, or the nearer white light of the tungsten lamps, or from mantle burners, especially if the latter are equipped with amber light mantles.

"Our lamps are easy on the eyes, note the high uniform intensity of illumination and the total absence of halation, as shown by this photograph," says the lighting specialist salesman. Yet halation is practically due to the thickness of the glass used for a plate, the glass being merely a support for the sensitive photographic emulsion. Halation is caused by the reflection of rays of light from the back of the plate; a thick plate, or a plate backed with flashed opal, or with a piece of white blotting paper would intensify the halation effect many times. There is

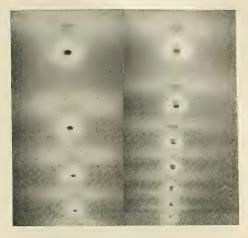


FIG. 4.

consequently very little halation with the thin film in general use with hand cameras when backed with red or black paper, and less with properly prepared backed plates.

The professional photographer who understands the photographing of lighting installations can actually clearly define a bowl-frosted tungsten lamp in a clear Holophane reflector, in a photograph of 30 minutes' exposure, a condition which could hardly be said to be free from glare.

After due care has been exercised in the choice of plate, lens opening, and time of exposure, manipulation in development may upset all previous assumptions. Illustration A in Fig. 2 was given five minutes' exposure with the same camera, lens, diaphragm, film, and in the same room with the same lamps as illustrations E and F, which were 60 and 90 seconds, respectively.

The film in Fig. 2 was developed to a much less density than the film in Fig. 3; all of the latter, C to H, were on one roll and were given the same development.

It is not a difficult proposition to insure equal development for plates or film, the exposures of which have been made about the same time, and with a similar time interval between the exposure and development of each film section or plate.

The next operation where changes may creep in is in the printing. Again, "without retouching the negative" effects similar to E and G and F and H

are easily possible. E and G are from one

negative, as are also F and H.

In "before and after" taken pictures installations are invariably shown for the "before" in such dense darkness that you might well join with the demonstrator in congratulating the owner of the new lamps on his good judgment and wisdom in making the change. The explanation is invariably offered "this old installation was given the same time of exposure as the new," the assumption being that where an intensity of 2 foot-candles is effective, the apparent brightness of the print will be proportional to that secured with the second photograph in the same room with a similar exposure and 4 footcandles average intensity. In the room in illustration C, Fig. 3, the average intensity was 2 foot-candles, while in the other room, D, E, F, G, H, the average was 4 foot-candles.

C and D were each the result of 30 seconds' exposure, while E G was 60 and F H 90 seconds.

C, D, G and H were developed and printed exactly the same; as negatives they were on one piece of film, and in printing one piece of paper was used insuring practically similar conditions throughout, the only difference being the time of exposure of the negatives.

That halation is not a quantitative indication of glare is shown very clearly on C and D, Fig. 3, where the halation effect is greater in D. In C the light units were 100-watt, bowl-frosted, metallized filament lamps, with flat Holophane reflectors, while D is equipped with 60-watt,

bowl-frosted, tungsten lamps, with satin finished Holophane focusing reflectors of a sufficient depth to practically cover the lamps, and to the eye the apparent discomfort and the glaring effect is less in room D. Another interesting point is brought out in illustrations A and B, Fig. 2. Due to the comparatively long exposures those parts of the negatives corresponding to the filament positions in the lamps because positives in the negatives, and are shown black in the prints. In A Alba reflectors were used, while B was equipped with the satin finished Holophane reflectors. Fig. 4 shows an enlargement of the central ceiling units from the negatives A and B, Fig. 2, and it may be noted that the high intrinsic brilliancy at the tips of the lamps is continued, with but a slight reduction in brightness, up into the satin finished Holophane reflector, almost the full length of the lamp filament, but in the case of the Alba reflectors this higher intensity is cut sharp at the edge of the reflector, and even a 15 minute exposure failed to change this apparent difference in reflector brightness.

All these pictures were taken with a hand camera, with six exposures, $3\frac{1}{2}$ inches by $4\frac{1}{2}$ inches, non-halation, orthochromatic Eastman film cartridge, with a Goerz Dagor lens, having a focal length of 5 inches, and working at full opening F/6.8. The converging effect shown by the side walls was due to tilting the camera to bring into the field the same lamps which would be in the average normal indirect vision of a man seated at a desk in either end of the room.

Lighting an Art Gallery

By M. Luckiesh

The lighting of art galleries presents great difficulties which severely tax the ingenuity and resources of the illuminating engineer. Glare due to regular reflection from the paintings is the most difficult element to contend with in lighting them. This means at once that the light must come from many directions, and no vicible sources of high intrinsic brilliancy

i with complete success. The

light, however, should be directed toward the walls, in order to obtain an installation of high efficiency, and it is the duty of the illuminating engineer to produce satisfactory results with the lowest wattage possible.

This article describes a rather unusual lighting installation in an art gallery which had previously been lighted very unsatisfactorily by means of localized gas units in silvered reflectors. The room, a narrow section of which is shown in Fig. I, is 22 feet by 28 feet, with a ceiling 15 feet 6 inches in height. In the center of the ceiling is a fancy domed skylight 13 feet 6 inches by 16 feet. The glass, the contour of which is shown by the dashed line, is semi-diffusing, owing to its wavy character, and is wrought in various leaded designs. The extreme height of the dome above the floor is 18 feet. The paintings occupy the wall space from 5 feet above the floor to the ceiling, while around the lower walls stand marble statuary and bric-à-brac. The space above the ceiling skylight, while none too large, afforded room for special reflectors which could direct light through the semi-diffusing glass to the walls of the room.

Several types of reflectors were investigated in various positions, and finally it was decided to adopt silvered reflectors containing frosted lamps for the border lights designated by A in Fig. 2. Twenty-one of these reflectors were used, each



FIG. I .- ARRANGEMENT OF LAMPS.

containing a 100-watt lamp. The manner in which they are hung is shown in Figs. 1 and 2. Frosted lamps were chosen so that their low intrinsic brilliancy would make them quite inconspicuous through

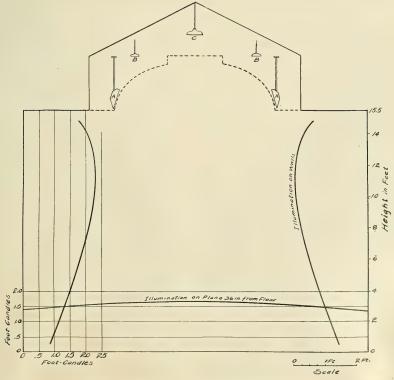


FIG. 2.—THE EFFECTS OF THE ILLUMINATION.

the glass. In order to illuminate the walls close to the ceiling, it was necessary to hang the reflectors low and quite close to the glass. Frosted lamps diminish rapidly in candle-power, due to dust, but owing to the fact that the space between the skylights is quite dust-free, little trouble is expected from that source. The reflectors A were tilted, so that the maximum flux was incident on the walls. Above the ceiling skylight and about 2 feet below the roof skyight were hung six diffusing reflectors, B, each containing a 60-watt lamp and one reflector, C, in the center containing a 120-watt lamp. The walls and beams between the two skylights were painted white, and considerable light is diffusely reflected in this attic space. This flood of diffused light affords a light background, so that the border lights are not conspicuous through the glass.

Photometric measurements on the floor and walls show that the resultant illumin-

ation is all that could be desired, and the absence of glare from the paintings is very gratifying. The illumination of the walls and floor is shown by the curves in Fig. 2. The average illumination on the paintings is over 2 foot-candles, while that on the floor is about 1.5 foot-candles. With only the lamps burning in reflectors B and C an expenditure of 480 watts gives about This was .4 foot-candle on the floor. found to be a very pleasing intensity of illumination when it was not necessary to view the paintings. The efficiency of the installation is high, considering the area which must be highly illuminated. The area of walls and floor is about 2100 square feet, while the total wattage of the lamps is 2580, making an average of about 1.2 watts per square foot. The installation meets with the approval of all concerned, and is plainly a victory of artificial lighting over natural lighting from the standpoint of light distribution.

Fond Du Lac's Ornamental Street Lighting

Fond du Lac, Wis., is pretty widely known throughout the country as a "pretty little town." But, what is more, it is as a matter of fact a very "aggressive little town"—if, indeed, town is the word to use, for it has a population of over 18,-

To the casual visitor, however, and aside from all its natural attractiveness and business get-up it has recently become enrolled as a "great white way town." Many other communities in Wisconsin may well have cause for jealousy toward Fond du Lac, whether by day or night, from this cause alone.

Not long ago there were wooden poles and wires about the streets, but the Common Council recently passed a resolution to do away with this; and in co-operation with the Eastern Wisconsin Railway & Light Company an ornamental street lighting installation was brought about. The merchants paid the cost, according to assessments by a committee of themselves appointed for that purpose. The city pays for the lighting as well as the maintenance for the lamps.

As a year or so passes by it will be interesting to know, as closely as can be ascertained through the business men's association, how much better off, from a business standpoint, Fond du Lac will find itself than it was before its ornamental street lighting.

There are now 58 lighting standards carrying four 60-watt tungsten lamps with one 100-watt tungsten lamp at the top of each of the clusters. There is room for more standards, and doubtless there will be more before the year is up.



FIG. I.—NIGHT VIEW, SHOWING EFFECT OF NEW ILLUMINATION, FOND DU LAC, WIS.



FIG. 2.—DAYLIGHT VIEW, SHOWING ORNAMENTAL EFFECT OF NEW LAMP-

A Twentieth Century Review of the Progress of Illumination During The Nineteenth Century

(Concluded)

By Roscoe Scott

FIFTH DECADE.

Another stride of our ten-league boots brings us up to the middle of the nineteenth century, and we cover a period of vast improvement in candle manufacture, industrious experimenting on arc lights, promising work on incandescent electric lamps, as well as the steady growth of the gas industry and the beginnings of the

modern petroleum industry.

Composite candles, or "composites," composed of stearic acid and stearin, were first manufactured about 1844. change in the material used for candle grease, together with a change in the design of candle wicks from a circular to more or less elongated cross-section, resulted in time in the relegation of those ancient household implements—the snuffers and snuff trays to the scrap heap and the antique shop.

Commercial arc lighting was dimly foreshadowed in 1844, when the French physicist, Foucault, experimenting with the carbon deposited in gas retorts and using this in connection with a Bunsen battery, produced such a steady and continuous light that he was able to use it for photographic purposes. Foucault's arc was forerunner of a great many types of arc lamps, which were to make their appearance from this time on until about 1860, none of which, however, combined the practical requirements of simplicity and reliability to a sufficient degree to bring them into widespread use, especially at a time when the dynamo—anything but a precocious youngster-was idling away a protracted infancy in its cradle-the laboratory.

J. W. Starr of Cincinnati (a protégé of the noted philanthropist, George Peabody) tackled in grim earnest the problem of inventing a practical incandescent electric lamp, and his efforts resulted in the so-called Starr-King lamp, patented in England in 1845, when its inventor was

only twenty-three years old. Two years later-in the same year, by a remarkable coincidence, that Thomas A. Edison was born-poor Starr had worked and worried himself to death; had he lived to complete his experimenting, it is just conceivable that the successful incandescent lamp might have been brought forth some thirty years previous to the time that it actually was invented. Starr's lamp had a Toricellian vacuum, the vacuous chamber, like that in the top of a barometer tube, being formed by the inversion of a glass tube containing mercury, and the incandescent body consisted of a thin stick of retort carbon about 1/8 in. square in cross section. The lamp gave a good, bright light when new, but its bulb blackened rather quickly, and it was further handicapped by the non-existence of a practical system of electricity supply.

SIXTH DECADE.

The years 1850 to 1859, inclusive, were like the ten years just preceding, in being productive of considerable improvement in the art of illumination, yet not characterized by such phenomenal progress as was made in the first, third, fourth, eighth and tenth decades. In particular, the invention of the atmospheric burner by Bunsen in 1855 and of the safety match by the Swede Lundström in the same year may be noted. The American petroleum industry received a strong impetus in 1859 by Col. E. L. Drake's successful boring in Pennsylvania, which caused the market to be flooded with petroleum at prices never before deemed possible and led to the importation of lamps from Germany for its consumption. The first American patent on a petroleum lamp is said to have been taken out in this same year. As the sperm whale had now become exceedingly scarce—in so much that the hardy sailors of New England and Old England were forced to push their unrelenting pursuit of it into the Arctic and Antarctic Seas—the introduction of kerosene oil as a fairly cheap substitute for whale oil was indeed most fortunate. It was at least a better substitute than that murderously explosive combination of turpentine and alcohol, known as "camphene" or "patent fluid," which was used to a considerable extent before kerosene was generally introduced.

It was not until 1853 that illuminating gas was available in Rome, the "Eternal City." Much more rapid and complete has been the spread of electric service during the thirty years just rounded out, since the first electric central station was established, than was the spread of gas service in an equal length of time counted from its incipiency. The more enthusiastic reception that electricity received was, however, due largely to the missionary work of the gas pioneers, who had already overcome the stubborn prejudice of the masses against the fundamental idea of a central supply of the illuminating "fluid."

SEVENTH DECADE.

A pronounced lull in the development of artificial illumination may be noticed during the sixties; in fact, the writer has not found any important events on record along these lines for the years 1861, 1862, 1868 and 1869. To what extent the American Civil War was responsible for this inactivity, he does not venture to opine.

In 1860 the British standard candle, generally believed to be the oldest legalized standard of light, was defined by Parliament as a spermaceti candle, 7/8 in. in diameter, burning 120 grains per hour. In 1864 a candle embodying a minor improvement—namely, the now familiar tapering or self-fitting lower end-was patented by J. L. Field. The storage cell invented by M. G. Planté in 1860 may be considered as a contribution to the progress of illumination, for it is not only a valuable auxiliary or emergency apparatus in many electric lighting stations, but is the source of energy for several specialized applications of the electric light, as, for example, miners' headlights, automobile lights and the electric lighting of steam railway trains. It was in 1866, by the way, that preliminary tests on gas for train lighting service were made, both in Germany and on the Reading Railroad in this country. Electric train lighting was, of course, at that time a nonentity.

EIGHTH DECADE.

The contrast between the stagnation of the sixties and the floodtide of the seventies is indeed remarkable. In the opening year of the latter decade a patent (No. 1668 of the British Patent Office, dated June 9, 1870) was granted to Z. T. Gramme of Belgium on a really practical continuous-current dynamo. In 1875 the Sprengel vacuum pump, which became almost immediately an important factor in the solution of the problem of successful incandescent lamp manufacture, was introduced in England. In the following year Jablochkoff introduced his famous "electric candle," consisting essentially of two parallel carbon rods separated by a thin combustible or fusible insulating barrier, across the top of which an electric arc played. Thousands of Jablochkoff candles were sold, principally in Europe, before they were superseded by the more modern arcs and incandescent lamps.

Meanwhile two American geniuses, Charles F. Brush and Thomas A. Edison, had set their brains and their hands to work upon the stupendous and hitherto unsolved problem of adapting electricity to general lighting purposes. Brush* exhibited his first arc lamp of the wonderfully simple and successful ring-clutch type in 1877, and in the following year produced that other indispensable feature of his arc lighting system, the series arc dynamo, and started campaigns of arc light introduction all over the world. Four years later Brush arc lights were in regular operation in Shanghai and Tokio.

In the year 1879 several experimenters were working on the incandescent lamp problem, notably Sawyer and Man, who experimented extensively with filaments of carbonized paper; Lane-Fox, who used vegetable fibers; Swan, who in February of this year publicly exhibited a lamp with a filament of parchmentized cotton thread, and Edison, who experimented with substances too numerous to mention here. Edison's famous exhibition of his com-

^{*} See "The Arc Light," by C. F. Brush, Century Magazine, May, 1905.

plete incandescent lighting system at Menlo Park, N. J., took place late in December, 1879, and attracted visitors, including prominent capitalists, from all over the country. This exhibition of the first complete system of incandescent electric lighting in the world may be considered the crowning, as it was the closing, event in the progress of illumination during this decade.

NINTH DECADE.

Development during the years 1880 to 1889, while not as cataclysmic as the flood of events we have just been considering, was rapid and important. The flourishing electric sign industry of the present time can trace its fundamental idea back to a simple "lamp-letter" sign of six letters and sixty-five lamps constructed by Mr. William J. Hammer* and hung up in the concert room at the Crystal Palace Exposition in London in December, 1881. To-day the total number of sign lamp sockets in service in the United States alone is estimated by a certain prominent sign manufacturer as about electric 8,000,000—a figure which collateral information of a statistical nature shows to be but little, if any, too high. The threewire system of direct current distribution was first put into commercial operation in 1883 at Sunbury, Pa.; in 1886 Mr. George Westinghouse installed the first regular alternating current central station in America at Buffalo, N. Y., and during the entire ten years under consideration the central station industry was rapidly extending its roots and branches. By 1890 the incandescent lamp had made its way into every civilized country.

Meanwhile experiments were being carried on by Karl Auer von Welsbach in Dr. Bunsen's laboratory at Heidelberg that were destined to breathe new vitality into the gas-light industry. Eighteen hundred and eighty-five is said to be the year in which Dr. Welsbach discovered the practicability of improving the efficiency of the gas lamp by the use of mantles, made by saturating cotton fabric in a solution of certain salts and burning out the organic matter. His early mantles, which were

made with erbium salts, gave a pronouncedly green light, and it was several years before the ingredients and their proportions for a thoroughly successful commercial mantle were finally worked

TENTH DECADE.

The century closed in a whirlwind of discovery. Welsbach brought out his thoria-ceria mantles-substantially the same as those on the market to-day-in 1890. In the following year the cellulose process of making carbon filaments for electric incandescent lamps was developed, and two years later the cellulose filament was generally adopted in place of the bamboo filament. The mercury vapor lamp was originated by Arons in 1892, and at a considerably later date was developed to a point of greater commercial practicability by Cooper Hewitt. The invention of the practical inclosed arc lamp was announced at a convention of the National Electric Light Association in 1894, when Mr. L. B. Marks described the first lamp embodying the points that made the inclosed arc, for a period of about ten years, the favorite unit for high candle-power lighting in America. In this same year the prepayment gas meter, known in this country as the "quarter meter," was perfected in England. In the following year the Italian Malignani devised the "chemical exhaust" for incandescent lamps, which improved their average quality, at the same time reducing the expense of their manufacture, and was largely responsible for the reduction in price of lamps in barrel lots in 1895 from 321/2 cents to 20 cents apiece.

The Moore tube light, an entirely new departure as regards the dimensions of the light-source and the high voltages successfully employed, was introduced by Mr. D. McFarlan Moore in 1896. The research. work of Dr. H. Walther Nernst led to a patent application in the following year. The Nernst lamp, too, was a radical departure from previous illuminants, although the principle upon which it operates-namely, that certain substances that normally are practically non-conductors of electricity become conductors when their temperature is raised-had been noted

several years before by Jablochkoff.

^{*} Arthur Williams: Report on Sign Lighting, N. E. L. A. Convention, 1903. Mr. Hammer also chilt the first flashing sign and the first motordriven fias er.

Right on the heels of the Nernst lamp came the first successful metal filament electric incandescent lamp, the osmium lamp of Auer von Welsbach. This lamp, while not destined to find a very wide market, owing to the rareness of osmium, pointed the way to the manufacture of the standard metal filament lamps of to-day. So limited indeed was the available supply of osmium and so necessary was it thought to conserve the same that osmium lamps were not sold outright to consumers, as a rule, but were merely rented.

In 1899 the Bremer flame arc lamp was announced, and in the following year Bremer exhibited at the Paris Exposition a model having four special carbons, and so arranged that the light produced was reflected downward. The flame arc, it may be remarked, represented by far the most efficient commercial means of transforming watts into lumens that had been discovered, although not necessarily on that account the most economical unit for practical illumination requirements. useful improvement in incandescent lamps was made in the same year when W. J. Phelps took out his first patent on turndown electric lamps.

Without following in minute detail the progress of illumination since the close of the nineteenth century, it may be well to bring the main threads of development up to the present "year of grace." In 1900 the inverted gas burner was perfected and

made possible the inverted mantle gas lamps which have now so generally superseded the upright. The next year brings us to the early development work on the tantalum filament electric incandescent lamp; a couple of years later experimental tungsten filament lamps were made, leading to the placing of this lamp on the market soon afterward; and at least as early as 1907 it was noticed by incandescent lamp manufacturers that tungsten under certain conditions appeared to possess the property of ductility when cold. It was hoped that some time it might be possible to produce ductile tungsten wire. 1908, according to Mr. J. E. Randall of Cleveland, it was believed that it would be possible to produce ductile tungsten; in 1909 experimenters were sure that ductile tungsten could be produced; in 1910 it had been proved beyond doubt that ductile tungsten could be produced, and in 1911 ductile tungsten was produced on an extensive commercial scale in the manufacture of Mazda lamps. This achievement alone, impossible as many believed it, even for a time after its accomplishment, should be sufficient to make the second decade of the twentieth century take high rank for improvements in the materials of artificial illumination. Whatever else, after this excellent start, may be added to its credit before 1920 will beto use a contractor's term-" all pure velvet.'

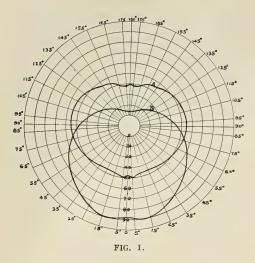
Increasing Efficiency of Translucent Spheres

By H. C. MEREDITH

It is a well-known fact that to make use of any accessory in artificial lighting which adds to the decorative or artistic value of illumination, some efficiency must be sacrificed. In commercial and decorative lighting one must deal with various kinds of illuminating glassware, such as shades, balls, spheres, other totally inclosing envelopes and various kinds of decorative designs. In the totally inclosing envelopes used in commercial lighting, it is very desirable that such glassware diffuse well, transmit efficiently and non-selectively, and that it have the proper density

to hide the real source of light from view and to cause the entire ball or sphere to appear as the source. In addition to these qualifications, selective transmission is desired in some cases of decorative lighting.

Since practically the only modification made upon the distribution curve of a bare lamp by translucent spheres or balls, aside from the absorption factor, is to cause the distribution curve to approach a circle more closely, a great amount of the light being transmitted in the upper hemisphere. Consequently, all light above the horizontal is lost, except that when himally



reaches the working plane by multiple reflection.

An interesting experiment was recently carried on by the Engineering Department of the National Electric Lamp Association on a 10-inch, two-piece translucent sphere, and is indicated graphically by the distribution curves here shown. Curve "A" shows the distribution of the sphere when inclosing a 100-watt clear Mazda lamp. Calculations show that in this case the sphere transmits 78 per cent. of the light emitted by the lamp in the upper hemisphere and 76 per cent. in the lower hemisphere. A Holophane Stiletto reflector M-40 was placed in the same sphere so that its edge was covered by the brass band connecting the two hemispheres, thus obscuring from view the dark band which would otherwise appear. The distribution curve obtained from this combination with the same lamp is shown by curve "B." In this case the amount of light transmitted into the upper hemisphere was reduced 41 per cent., while that transmitted into the lower hemisphere was increased 32.6 per cent. Since the spherical efficiency of the unit in the first case was 77 per cent., and 73 per cent. in the latter, only 4 per cent. is lost in the mean spherical efficiency, while the quantity of light below the horizontal is increased to a marked degree.

Another point worthy of consideration is that with the use of the inner reflector, all of the mean lower hemispherical flux of the bare lamp is thrown into the lower hemisphere; this, in addition to giving a more useful distribution, compensates entirely for the absorption of the sphere. With the sphere alone there are 260 lumens within the 80-degree zone, or 2.6 lumens per watt, while within the same zone using the inner reflector there are 364 lumens, or 3.64 lumens per watt. The upper half of the sphere appears slightly darker than the lower half, but when the unit is hung at the usual height this difference is so small as to be unnoticeable.

Considered from all standpoints, the combination is practicable and a more efficient installation can be made with the combination than with spheres alone. By using larger sizes of the Holophane type M reflectors, the principle is applicable to the larger spheres.

Scientific Illumination of Working Surfaces

By MELVIN SPENCER

Progress has been the slogan of the past century. Every branch of science has experienced continual improvement, and the lighting field is no exception to this rule. Results which were unattainable a decade ago, or within two or three years, are now commonplace.

In this age of advancement, however, we and here and there something being do at the present time just as it was do not be age of our grandfather—a

kind of association of ideas had developed to such an extent that whether a thing is capable of improvement or not we instinctively look for a given set of appliances that we are accustomed to associate with a given thing.

In the field of the illuminating engineer such a tradition has grown up about our ideas on the illumination of working surfaces.

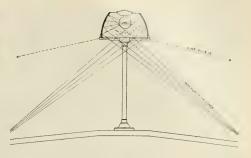
Although every year has seen improve-



TYPICAL FRINK DOUBLE-DESK REFLECTOR.

ments in other branches of lighting, our working planes are illuminated in the same crude fashion employed by our fore-fathers, simply because we have become accustomed to associate the old methods with this phase of lighting. The evil effects of poor illumination and the deterioration of human eyesight can often be traced to the prevailing methods adopted for local illumination.

Too little attention has been paid to the proper protection of the eyes in relation to

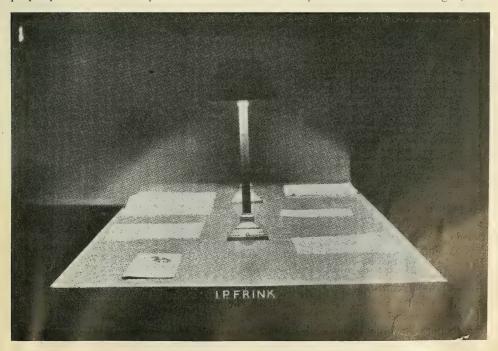


A METHOD OF LIGHTING A DOUBLE DESK.

light sources, and a little consideration of the needs and requirements of the lighting will amply repay investigation.

The chronic defective vision of those accustomed to close work under artificial light is proof positive that something is radically wrong with the tools he is compelled to use. Those accustomed to long and close application are in need of all their nervous energy to perform the functions of their brains and any nervous energy drained from the brain cells to help out the eyesight must be done at a sacrifice of efficiency in their work.

The eye is a most delicate organ, and



A DESK WITH EVENLY DIFFUSED LIGHT OVER THE ENTIRE WORKING SURFACE.



MAIN. READING ROOM, ST. LOUIS PUBLIC LIBRARY, SHOWING DOUBLE-DESK REFLECTORS ON READING TABLES.

we are told by the medical world that the normal eve has deteriorated since the introduction of the electric light, and that this is due not so much to the light source as to the way in which the electric lights are used. In work requiring close attention, such as reading, figuring, writing or draughting, that portion of the eye known as the fovea is used, the eye muscles automatically focusing the object on this portion of the retina. Night vision is possible by the use of the rods, which contain a chemical solution known as the visual purple, which is drained under poor lighting, causing eye fatigue and strain, which, if persisted in, develops defective vision.

A retina properly protected from a light source is able to distinguish details, which would be quite blurred if the source of light was exposed to view. It is surprising to note how the visual acuity varies, due to this fact.

In a number of theatres, where a quick shift of scene is desired, a number of powerful lights, bordering the stage, are turned on in such a way that the light source is exposed to the direct view, and the audience is practically blinded so that any movement on the stage is indiscernible. This, of course, is an exaggerated case of decrease of visual acuity, but proves the point that a light source exposed to the eye has the effect of decreasing the acuteness of vision. The same phenomenon is perhaps better known to motorists who are accustomed to ride at night—details in the road, plainly discernible by means of the acetylene lights, are rendered practically invisible when approaching an arc lamp. The eye is automatically accommodated to screen the delicate organism from the brilliant source of light, and in so doing loses its ability to distinguish detail.

Another important point to consider is the unconscious attraction that an exposed light source has for the eye. In order to bring out the detail of an object, as has been said before, the muscles of the eye must focus that object on the fovea, and when the eye is drawn, as if by a magnet, toward a brilliant light source, two contrary forces are set up, with the result that the object is not accurately focussed, but subjected to a strain, with the result that the details are not brought out.

Thus it is seen that these details have a direct influence on the success or failure

of lighting working surfaces.

Let us consider, for a moment, the manner in which the average reading table (a typical example of the working surface) is lighted. In nine cases out of ten we find the same method as when a candle was first used with a shade—a cone shade—more liable to be translucent than opaque, with some sort of swinging or stationary bracket. Every one has experienced difficulty with this type of shade when reading, and has endeavored to remedy its faults by changing the position and height of the standard, but never with sat-

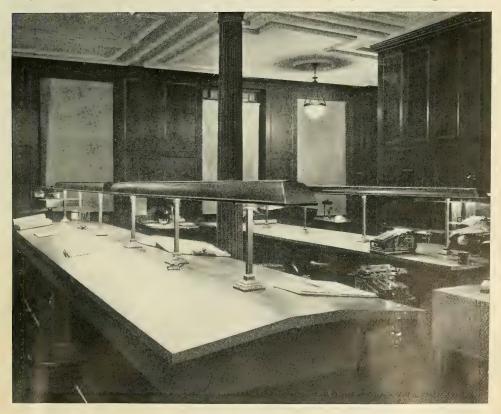
isfactory results. It has become the despair of librarians, some of whom have experimented almost beyond the limits of human patience, but with no avail, and the remedy is not to be found in any possible combination of this equipment, because the principle underlying is fundamentally wrong.

The difficulties experienced are of a two-fold nature—either a distracting glare from the light source itself in the eye of the reader, or by equally annoying reflected glare on the reading plane, or a

combination of both.

If we consider for a moment the simple law of reflection we will find that with the use of a standard and shade, no matter in what position placed, the light is reflected at an angle of approximately 45 degrees, which will make a bad glare line at some point on the reading page.

The only way to avoid this is to cause the reflected light to strike the working plane at an angle approaching 180 de-



FOURTH NATIONAL BANK, NEW YORK, SHOWING SYSTEM OF DOUBLE-DESK REFLECTORS.

grees, when it will be reflected below the line of vision, resulting in the entire absence

of glare.

In order to accomplish this seemingly impossible state of conditions, the principle of cross reflection has been utilized, whereby the light is thrown on the working plane at such an angle that no reflected light acts directly on the pupil.

In working out the proper illumination of a working plane, under these conditions, it is essential that due attention be paid to the height of planes and dimensions of it, as unless the standards supporting the reflectors are of the proper height, results are impossible.

This same principle can be applied effectively to any working plane, such as draughting boards, etc., and will do much to improve existing conditions.



DOUBLE-DESK LIGHTING, BANKERS' TRUST COMPANY, NEW YORK.

Indirect Illumination—A Few Cost Comparisons

By Augustus D. Curtis

The advancement in the art of illumination is so rapid that books on the subject but a short time off the press are obsolete. Those of two years ago scarcely mentioned indirect illumination, while this method of lighting in certain localities is now so common as to scarcely excite comment. This is really surprising, owing to the comparatively recent date of the introduction of the high efficiency reflectors that make indirect illumination commercially feasible. Those who two years ago predicted that it would soon come into general use see the first great step toward that end as the realization of the public increases, that, for those places where it is practicable, there is no comparison in the desirability of the two methods of illumination.

It is now a well-known fact that visual

acuity (seeing efficiency) does not depend upon the intensity of illumination, and that with indirect illumination a lesser degree of intensity of illumination on the working plane is necessary, due to the increased seeing efficiency. Many office managers contend that the efficiency of their office force has increased very materially with the use of indirect illumination. Some state the increase is from 10 to 15 per cent. To figure this exactly is a difficult matter—as difficult as to figure increased efficiency with proper ventilation, heating or other office conditions; however, it is now a recognized fact that correct illumination is as important hygienically as any of these. To estimate this efficiency many things must be considered, namely, reducing of errors, hygienic working conditions, fewer absences due to sickness, expediency in working and in many instances the retention of services

of valuable employees.

The office shown is a typical example of modern office practise. The indirect lighting makes the use of desk lamps unnecessary and reduces the number of fixtures to a minimum, and at the same time produces an evenly distributed illumination, which makes all parts of the office available for work.

It is true that the general diffusion of light in an interior illuminated by indirect lighting is very apt to give one the impression that more current is required than would be required by satisfactory direct lighting; however, in making a comparison as to the cost of installation and operation between direct and indirect lighting one must consider as a basis of comparison an installation of direct lighting in which the quality of illumination is up to the growing public demand, that the glare be eliminated, and by proper diffusion protection be furnished the eye.

It has been and is the general practise to compare indirect lighting installations (which are scientifically arranged to give the proper intensity of light, diffusion and have all the necessary attributes of a perfect installation) with direct lighting installations which are, in a majority of instances, unsatisfactory to say the least. As has been stated before, a comparison must be made of the two installations for the same interior and design to give the same for a cost comparison wiring, fixtures, maintenance and current consumption. Even this does not consider the artistic effect nor the hygienic conditions involved. In the specific case of comparison which follows the fact must not be lost sight of that the indirect installations are guaranteed to fulfil all of the conditions necessary for correct illumination. instances an increase in current consumption is necessary by indirect methods; for instance, where but a small portion of a large interior is required to be illuminated for close work, and in another case where there is an increase, it is due to the fact that direct illumination was not satisfactory.

Questions of comparative current consumption are so frequently asked that data on specific interiors of various kinds in different parts of the country have been requested and are presented herewith just as received. They will show, generally speaking, that indirect illumination costs no more than satisfactory direct illumination. This statement is based on the assumption that the powerful X-Ray Eye Comfort mirrored reflectors, scientifically designed for the purpose, are used for the indirect lighting, and one should bear in mind that the economic results as are shown in the following exhibits are only possible by the use of the equipment mentioned.

The question of current consumption, however, is of small importance if a close analysis is made as is now happily becoming more and more the practise of office managers and efficiency men. The following reductions made in the case of a 20 per cent, increase in current consumption by indirect lighting in the first counting room statistics shown (that of the British Foreign & Marine Insurance Company of New York) can be applied to any office where a large clerical force is employed. Fifty clerks at an average salary of \$15 per week equals \$39,000 for salary payroll per year. Estimating but an increased efficiency of 10 per cent. for each employee for the two hours per day in which they work under artificial illumination, the total number of hours per year for 50 men would be 120,000 hours, figuring at 48 hours per week, being the office hours. Taking 2 hours per day for 300 days for 50 men, 30,000 hours. The salary payroll for 120,000 hours is \$39,000, then for 30,000 hours would be \$9,750. If 10 per cent. of \$9,750 is taken as the increase in efficiency of the office force then \$975 would represent in dollars and cents the saving per year to the employer on account of the installation of rational lighting for the office force. The \$25 increase in the lighting bill is infinitesimal as compared to the saving thus effected in working force efficiency, besides the great benefits which are manifest from a welfare and hygienic standpoint.

COMPARATIVE COST OF DIRECT VS. INDIRECT INSTALLATIONS.

AUDITORIUMS.

	hore Country		
Area, 9,8	840 sq. ft.; wa	tts per sq.	ft., 1.12.
Saving in	fixtures		\dots \$517.50
Saving in	lamps		189.25
	wiring if ind		
specified			485.00

\$1,190.75



FIG. I.—TYPICAL EXAMPLE OF INDIRECT LIGHTING IN A MODERN OFFICE.

Tungsten lamp comparison: Saving per year maintenance (lamps, cleaning, etc.)\$50.00 Current saved	Indirect at a Same cost, g
Current saved	Pabst Theatr
5½ K. W. at 6c. per K. W. H \$135.00 Wired for direct lighting and afterwards changed to indirect. Y. M. C. A., Winnipeg, Man., Can.:	Original carbon wattage Indirect install
Area, 2,356 sq. ft.; watts per sq. ft., .7. Watts.	Saving Equals \$515.
Direct lighting. 1,750 Indirect lighting. 1,700 50	Moffet Studio Area, 450 sq.
Decrease, 2 per cent.	, ,
CHURCHES.	Original install
Eighth Church of Christ, Scientist, Chicago: Area, 7,920 sq. ft.; watts per sq. ft., 1.47.	(General illu Indirect install
Saving in fixtures and wiring\$1,200.00 Watts. Direct lighting	Saving Decrease 6 p
Indirect lighting	Law Library,
Saving	Carbon lamp i Indirect install
Decrease 26 per cent., Tungsten lamp comparison.	Saving Decrease 43
Church in Dallas, Texas:	son.
$\begin{array}{ccc} & \text{Watts.} \\ \text{Direct lighting.} & 5,460 \\ \text{Indirect lighting.} & 4,400 \\ \end{array}$	Windsor Hot Area, 2,400 s
Saving	Direct lighting Indirect install
Church in Rome, N. Y.: Originally lighted by gas.	Saving Indirect inst

Indirect at approximately the same cost. Same cost, gas comparison.		
THEATRES. Pabst Theatre, Milwaukee, Wis.:		
Watts. Original carbon lamp installation, total		
wattage		
Saving		
STUDIOS.		
Moffet Studios, Chicago, Ill.: Area, 450 sq. ft.; watts per sq. ft., 1. Watts.		
Original installation		
General illumination and desk lamps.) Indirect installation		
Saving		
LIBRARY.		
Law Library, Northwestern Univ., Chicago: Watts.		
Carbon lamp installation 3,720 Indirect installation 2,100		
Saving		
DINING ROOM.		
Windsor Hotel, Philadelphia, Pa.: Area, 2,400 sq. ft.; watts per sq. ft., 1.6. Watts.		
$ \begin{array}{llllllllllllllllllllllllllllllllllll$		
Saving		

unit ceiling fixtures a large number of ceiling fixtures and wall brackets. Decrease 21 per cent., Tungsten lamp comparison. Chicago Roach Hotel Chicago III:	Direct lighting installation
Chicago Beach Hotel, Chicago, Ill.: Watts. Direct lighting installation	(Same outlets used.)
	Increase
Saving	ciation and Construction Dept., Chicago: Area, 801 sq. ft.; watts per sq. ft., 1.5. Direct lighting installation
Manhattan Life Ins. Bldg., New York, N. Y.: Watts.	Indirect lighting installation
Direct lighting installation	Increase 20 per cent. The International Harvester Co., Manufactur-
Saving	ing Dept., Chicago: Area, 1,200 sq. ft.; watts per sq. ft., 1. Watts.
stores. Howard Kirkpatrick & Co., Bloomington, Ill.:	Direct lighting installation
Direct lighting installation of 12 500-watt arc lamps	watt desk lamps.) Indirect lighting installation 1,200 (Using six outlets.)
Increase	Saving
than offsets the increased current consumption. Increase 16 per cent., Arc lamp comparison. National Furniture Co., Indianapolis, Ind.:	Spencer-Kellogg Co., Buffalo, N. Y.: New installation (see illustration). Area, 2,980 sq. ft.; watts per sq. ft., 1.4.
Direct lighting installation. Watts. 24,000 Indirect lighting installation. 20,000	Townsend-Whalen Co., Philadelphia, Pa.: Direct lighting installation
Saving	Saving
(Indirect lighting was installed in an office of this company with a saving of 300 watts, or 25 per cent.)	ST. LOUIS COMPARISONS.
COUNTING ROOMS.	Southwestern Passenger Association, Commis-
British Foreign & Marine Ins. Co., Cotton Exchange Bldg., New York, N. Y.:	sioner's office: Area, 324 sq. ft.; watts per sq. ft., 1.3. Watts.
Direct lighting installation, consisting of	(One fixture, four desk lamps.)
120 drop cords with 25-watt lamps 3,000 Indirect lighting installation of 18 two-light chandeliers 3.600	Indirect lighting installation
Increase 600	Saving
Increase	on. 'Frisco Railroad, 'Frisco Bldg., 8th, 9th, 10th and 11th floors: Watts.
Taylor-Critchfield Co., Chicago, Ill.: Area, 3,380 sq. ft.; watts per sq. ft., 1.1. Watts.	Direct lighting installation (155 fixtures) 86,400 Indirect lighting installation (144 fixtures) 34,560
Direct lighting installation, consisting of 13 four-light chandeliers with prismatic	Saving
reflectors	ing load was burning eight hours per day, it would amount to the following: Original installation 21.6 K. W. hours, 21.6 K. W. × 2,496
and reflectors	6c. per K. W. hour equals \$3,295 per year. Indi-
Lazard Freres, New York: Area, 2,277 sq. ft.; watts per sq. ft., 1.6. Watts.	as shown. \$3,295 (less 60 per cent. saving is elected as shown. \$3,295 (less 60 per cent. saving), less \$1,358, or yearly saving of \$937 net.
Direct lighting installation	Decrease 60 per cent, \$937.00 per year. Missouri Pacific Railroad Co.: Area, 900 sq. ft.: watts per sq. ft., 1.3.
Saving	Watts. Direct lighting installation
L. H. Cook & Co., New York City, N. Y.:	Indirect lighting installation 1,200 (Two 6-light fixtures.)
Direct lighting installation	Saving
Saving	MEETING ROOMS. Southwestern Passenger Association, No. 1: Area, 625 sq. ft.; watts per sq. ft., 1.3. Watts.
The International Harvester Co., Sales Dept Chicago:	Direct lighting instellation Watts.
Area, 2,440 sq. ft.; watts per sq. ft., 1.25.	Direct lighting installation

Indirect lighting installation 800 (One fixture.)	Area, 1,000 sq. ft.; watts per sq. ft., .8.
Saving	Direct lighting installation
Southwestern Passenger Association: Area, 480 sq. ft.; watts per sq. ft., 3.7. Direct lighting installation. 1,920 Indirect lighting installation. 1,800 (Three fixtures.)	Dr. K. C. Campbell, Manitoba, Canada: Area, 180 sq. ft.; watts per sq. ft., 8. Direct lighting installation
Saving	Saving
Indirect lighting installation 1,200 Saving	Brandon City Council, Brandon City, Canada: Area, 1,758 sq. ft.; watts per sq. ft., 7. Watts. Direct lighting installation

Practical Notes on Illumination Design

By C. E. CLEWELL

From one standpoint the various methods of illumination design are classed as a distinct science, while from a second standpoint experience is mainly relied upon for the solution of such problems.

In the former, illumination results are derived from certain formulæ and constants; while in the latter, the selection of types of lamps and other items associated with the correct installation of the system are matters which are determined from the experience derived from other lo-

cations somewhat similar to the one in question.

A number of articles have been presented in the immediate past, setting forth illumination design as a distinct science, while in the following article some ideas are set forth regarding the practical aspects of illumination design as based on experiment and experience. In treating the material after this fashion, there is no intention to minimize the value of rules and formulæ, but rather to indicate what may be termed a proper balance between theory and practise.

THEORY AND PRACTISE.

The statement is sometimes heard that empirical methods of calculating and designing lighting systems are sufficiently exact to meet commercial requirements. It should be remembered, however, that methods of this kind were originally based largely on experience, and while engineering data and the work along the science of illumination have done much for the intelligent application of such methods, there is always a danger in the use of set rules in illumination work on account of the great diversity of conditions where

The term "Illumination Design" in the following notes refers to the working up of plans for lighting systems, having in mind the choice of lamp and the adaptation of this chosen lamp to a given location. The particular items involved are the intensity of the resulting illumination, uniformity of the light distribution, and the elimination of glare. To this end the illuminating engineer must make a judicious selection of the type of lamp to be used; must choose a lamp of suitable size and a sufficient number of lamps to produce the required intensity; must fix the most advantageous spacing and mounting of the lamps; must adapt the lamps by means of reflectors or globes to promote uniform illumination on the working surface; must utilize girders or other architectural details in protecting the eye from the bright rays of lamps; and must devise an economical method of switch control. The foregoing items obviously require careful study when working up the illumination plans, and the engineer dealing with these problems is now expected to meet the various requirements by supplying sufficient illumination at the highest efficiency consistent with an excellent result.

such application must be continually made.

There is even a danger in the use of empirical methods by the introduction of certain limitations expressed by more or less fixed rules. This statement is based on the results of extensive tests, which show that the average performance of lighting installations, although pronounced entirely satisfactory at the outset, are, in many cases, such as to warrant even a greater allowance for deterioration, due, for example, to the accumulations of dust and dirt, than would have been evidenced from tables containing the limitations to be taken into account with certain set methods.

The problems connected with illumination design are concerned, not only with the determination of the number of lamps required to furnish adequate illumination on the working surface at the outset, but should include, in addition, the very important, although frequently overlooked features associated with average performance.

In the calculation, therefore, of the number of lamps, the spacing distance and the mounting height necessary for a given floor space, not only must the effect of surroundings be given due care in their relation to the net illumination result, but the effects due to inherent deterioration of lamps, as well as the reduction of illumination due to accumulations of dust and dirt on lamps and reflectors, must also be definitely considered. It is through the medium of these so-called secondary considerations that there is ant to be a marked difference between illumination results based on what may be termed theoretical constants, and those in which practical operating conditions have been given due regard.

Another item from which there is some danger is the use of published constants, typified by the so-called "utilization efficiency" values which are met with on every hand in connection with various types of lamps and auxiliaries. There is a tendency to exaggerate, even to the point of misleading those who desire correct data, by the publication of "per cent. lumens effective" constants which have been determined under laboratory conditions, but which are seldom, if ever, ob-

tained under average performance conditions. From the standpoint of the illuminating engineer, such constants should never exceed the results obtainable under actual service, but should even include a factor of allowance to insure results which, on the average, may be in accord with such values.

From the standpoint of the manufacturer there is a natural tendency to express the light-giving qualities of lamps and auxiliaries at the highest attainable value under ideal conditions. This tendency is largely explained by the effort made to promote the sale of products by making a favorable comparison with competitive apparatus. It is believed, however, that in the immediate future illumination design, to be most effective, must be based on performance rather than on what may be here classed as laboratory data.

Table I.—Typical Average Performance Values of Utilization Efficiency, or Per Cent. Lumens Effective.

Light surroundings, low office..... Fairly light surroundings, factory office 27.4 Dark surroundings, low factory space... Dark surroundings, medium high factory space..... Dark surroundings, fairly high fac-30.8

tory space..... 29.1

In Table 1 "per cent. lumens effective" for various tungsten lighting installations are shown as derived from actual These values are service conditions. based on careful tests under extensive lighting installations and over a long time interval. A reference to this table indicates that the deterioration of lamps and reflectors due to dirt accumulations causes a large modification in the constants which would ordinarily be used were the calculations based on ideal conditions. The average values throughout given tests, as shown in this table, indicate the constants which should be applied when the conditions are the same as those surrounding the given tests, and when it is also desirable to take into account the average resulting intensity rather than the initial intensity when the installation has just been completed. It should be noted, however, in connection with a table of this kind, that great care must be exercised in the use of such constants to determine if the conditions of the location in

question are essentially similar to the conditions of those installations from which the test data has been derived.

A comparison of these values with similar constants as given by some manufacturers for new equipment indicates at a glance that the difference between ideal and practical conditions may be a very large item.

ITEMS CONNECTED WITH THE DESIGN.

Inspection of the Floor Space.—it is important at the outset, before attempting to calculate the size of lamps and their spacing and mounting, to inspect the surroundings, as well as the class, of work or other conditions to which the illumination must be adapted. In those buildings which are to be equipped with a revised lighting installation, an inspection of this kind determines the illumination intensity required, and to those experienced in this line of work the approximate size, type and number of lamps necessary.

Observation should be made of the dimensions of bays or floor space, the ceiling height and the height from floor to girder line in the case of industrial plants. Very often a blue-print giving this information is available. The class of work performed and the location of machinery or other building equipment should be roughly inspected, and the conditions of the space between floor and ceiling are a most important item. In industrial work the presence or absence of belting must be indicated and also whether the space between floor and ceiling is otherwise comparatively free from obstructions, as well as from dust, dirt and steam in suspen-Where crane service exists, the clearance between crane and ceiling is important in its relation to the size of lamp which may advantageously be used. Finally, the surroundings should be noted -whether light, medium or dark, and the type of circuits available; whether direct or alternating current, the voltage and frequency, and whether the lighting and power circuits are separate. In the case of new buildings which are not vet fully equipped these various items must be determined in advance and the design duly worked out and modified so as to take into account all such items.

Natural Light as Affecting Artificial Lighting Requirements. — The relation of natural lighting facilities, through the channel of windows and skylights, is an item not always given the proper consideration as affecting the artificial illumination intensities required. This inter-relation between natural and artificial light is obviously only effective when the artificial light is required during dark portions of the day, due either to clouds or fog, or, perhaps, to the early morning and late afternoon hours of winter days. In view of the fact, however, that there is usually a large interval, particularly in industrial plants, when artificial light is needed during many days in conjunction with a small amount of natural light, the various items that influence the artificial lighting system, as related to natural light, are important.

It is generally known that the intensity of artificial light, when such light is necessary during what may be termed the daytime, is dependent somewhat upon the natural light present. Under these mixed conditions of artificial and natural light, the artificial light should possess a higher value than would be the case if its use was limited to periods of complete natural

darkness.

The first modification that must be taken into account, therefore, in this connection, is the provision of a somewhat higher initial intensity of the artificial lighting system than would be deemed necessary under night conditions. The second consideration is in the matter of switch control. For the most economical result, particularly in those locations where a large number of medium-sized lamps are employed, the lamps near windows should be controlled from circuits separate and apart from those controlling the lamps in the interior portions of the building. The simple diagram shown in Fig. 1 indicates an uneconomical method of controlling the lamps; while the companion diagram in Fig. 2 shows an improved method. A reference to these two diagrams indicates that in the latter diagram the lamps at the interior of the building may be turned on while the work near the windows is still furnished with sufficient natural light.

SPACING DISTANCES OF LAMPS.

The ordinary empirical methods for calculating lighting systems determine at the

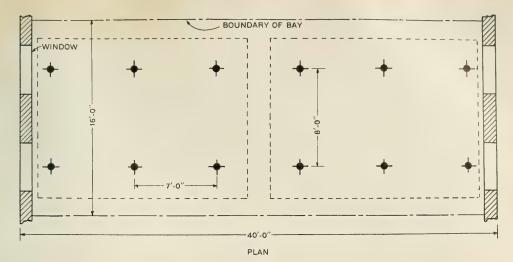


FIG. I.

outset the number and size of lamps necessary for the production of an adequate illumination intensity, following this determination by the location of the lamps in a more or less symmetrical manner over the ceiling space. It is obvious that by following this method the spacing distance is given secondary consideration.

Experience rather indicates that spacing distances should be given primary consideration, and the size and number of lamps determined on the basis of the chosen spacing distance. This conclusion is based on the important relation between the

directional features of the resulting illumination and the spacing distance employed. In Fig. 3, for example, an office is shown where the calculation of lamps based on empirical methods would indicate a satisfactory system by the use of 150-watt tungsten lamps. The arrangement of lamps shown in this figure is such as to produce an adequate intensity of light on the desk surfaces and by the use of suitable reflectors the illumination may be distributed in a fairly uniform manner. It has been found, however, that in an office with the ceiling

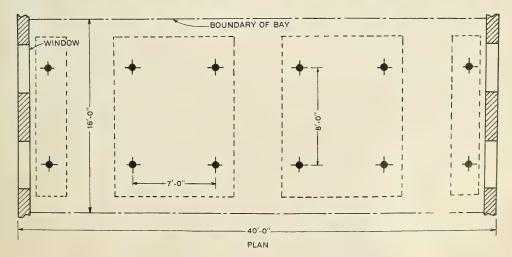
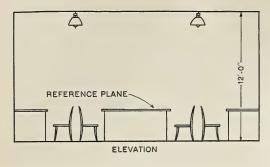


FIG. 2.



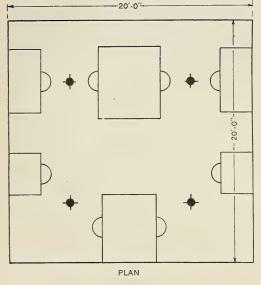


FIG. 3.

height in question a spacing distance of 10 feet, as shown in the figure, is entirely too large to accommodate desks which may be located irrespective of the location of

overhead lamps.

An improved design is shown in Fig. 4, where the determination of spacing distance has first been made on a basis of proper directional features of the light, and this determination of nine outlets is followed by calculations of the number and size of the lamps necessary. Tungsten lamps of the 60-watt size in this latter figure furnish essentially the same intensity of light on the desk surfaces as with the large lamps, and by the use of suitable reflectors may be made equally as uniform as in the first scheme; but the illumination on the desks when located without respect to the overhead lamps is

far better in the latter than in the former case.

This simple illustration serves to indicate the difference between the two methods, and also shows the fallacy which is apt to arise if the size and number of lamps is determined prior to, and separate from, the spacing distance. The illustration, while referring to a simple office location, is equally applicable to practically all illumination work, and values of spacing distances for various classes of locations are of a value almost equal to those factors which are used to determine the size and number of lamps required for the production of given intensities.

Table II.—Typical Spacing Distances for Various Ceiling Heights in Actual Installations.

	Ceiling	Spacing
Class of work.	height.	distance.
	Ft.	Ft.In. Ft.In.
Office	. 10	58x 76
Office		59x 73
Factory office	. 9	57x 59
Factory office	. 12	57x7I
Factory office	. 14	54x 57
Factory spaces		8 ox 8 o
Factory spaces		8 o x 10 o
	(8 ox 8 o
Factory spaces	. 16 <	and
	(13 0 x 14 0
Factory spaces	. 25	IO 0 X I2 0

Table II. indicates a series of spacing distances which have been employed for various ceiling heights and for different classes of work. It will be noted that the spacing distance varies somewhat with the ceiling height, and with the size of lamp selected.

LIGHT CONSERVATION.

Dark surroundings absorb otherwise useful light. Lamps which produce light in directions above as well as below the horizontal, if not provided with proper globes or reflectors, are not as efficient as they may be when thus equipped. A reflector, if properly designed, while intercepting otherwise comparatively useless components of light, redirects these components in a useful direction. The reflector, to be most economical, must furthermore redirect all the rays from the lamps in such a manner that the light may be distributed in an approximately uniform manner over the working surface. The scientific work, which has been conducted for the proper redirection of light from lamps is, therefore, a most valuable addition to practical illuminating engineering work.

The growing tendency to paint walls and ceilings a light color and to maintain them in this condition is favorable to more efficient illumination results. While encouraging the use of efficient lamps and reflectors, it is, therefore, important to emphasize the advantages to be derived from light colored surroundings and the illuminating engineer possesses in many instances the opportunity to forward this tendency when dealing with his clients.

GLARE.

The trying effect to the eye when subject to the direct rays of lamps either mounted too near the floor or not provided with shielding devices, is now a matter of common knowledge. It is, however, a matter of surprise and concern to those familiar with this effect to note the apparent neglect in avoiding this serious difficulty connected with many present day lighting systems. It is important, therefore, to emphasize the necessity for sufficiently high mounting of lamps under practical conditions.

It is interesting to note in this connection that through a comparatively large range of mounting heights the illumination efficiency of lighting systems is not seriously affected. It is recommended, therefore, that lamps always be mounted at such a height as to be relatively out of the line of vision, thus eliminating, to a large degree, the effect of glare.

Where the ceiling is very low, it is necessary to use small lamps, and particularly important to make use of reflectors which will properly shield the direct rays of light from the eyes, and if, in addition, the reflectors are chosen so as to increase the net illumination efficiency, the advantages derived by their use are twofold.

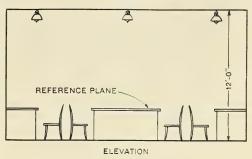
The warrant for devoting the foregoing space to a treatment of so simple a subject is due merely to the great necessity still felt for much educational work along the lines of the elimination of glare effect.

MOUNTING HEIGHT.

As previously stated, it is desirable to

mount the lamps sufficiently high to be out of the ordinary line of vision. This mounting height is very frequently determined by the clearance between crane and ceiling in industrial locations, or by other architectural features in various buildings. The mounting height has a distinct bearing on the size of lamp to such an extent that the size of lamp should be based on the mounting height in question. A reference to Table III. indicates the relation between size of lamp and mounting height for various actual locations. By referring to a table of this kind it is comparatively simple to choose the size of lamp most advantageous for given mounting conditions, provided the table is based on actual instances which have proved scientifically satisfactory.

(To be continued.)



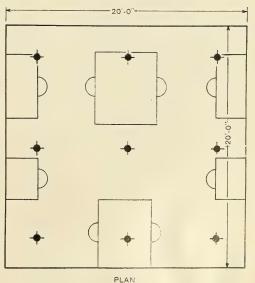


FIG. 4.

Industrial Lighting

The Field is Unlimited, the Possibilities Are Almost Beyond **Human Comprehension**

By Charles L. Eshleman

The industrial manager strives for three things:

(1) Increased output, (2) Improved quality, (3) Decreased cost.

They are the component parts of the word dividends.'

Three elements contribute to the realization of these aims:

(1) Efficient labor,

(2) Efficient machinery,

(3) Efficient lighting.

The importance of these elements can be more fully appreciated when we consider that the absence of any one of them renders the others useless. In other words, labor and machinery without light have no value.

The subject of this paper does not carry with it an obligation to discuss the subjects of efficient labor and efficient machinery. Even efficient lighting is too broad, because it covers the two subjects of:

(1) Daylight illumination, (2) Artificial illumination.

A discussion of daylight illumination involves the design and finish of buildings -whether large or small areas, high, medium and low studding; flat, sloping, open and closed ceilings, or saw-tooth roof construction. Although these details affect the location and spacing of lighting units, we must leave them to the discretion of the architect or building contractor and pass to a discussion of artificial illumina-

We shall endeavor to show,

(1) That efficient artificial illumination is necessary.

(2) That there are lighting units available for the purpose.

(3) How these units may be applied to produce the desired result.

(4) The effect obtained from their use. FICIFNCY ENGINEERING OF LIGHT.

Effic y engineering is the science of

stopping leaks. Coupled with scientific management it is the most important factor entering into the movement for the conservation of our natural resources. Our waste of to-day will be our dividends of to-morrow.

Example:

A wire-glass concern in Eastern Pennsylvania was going down for the third time. They had a market for their product, yet could not make a profit. They acquired the services of an efficiency engineer. After looking into their manufacturing processes, he asked one question: "How much glass is broken in the cutting room?" The answer was "40 per cent." He stated that he could get people to back them to the limit. In a few months the breakage was reduced to 10 per cent., and the company had clear sailing.

Efficiency engineering of light is part of this great national movement—the aim being to install an artificial lighting system that will allow a plant to operate at as high efficiency during the dark hours as during the sunlight hours of the day.

Efficiency of the Human Machine.

Industrial statistics show that the average cost of all finished products in the United States is one-third labor and two-thirds material.

Increased labor efficiency is, therefore, a very important factor in considering methods of reducing manufacturing costs.

Two things contribute to this efficiency:

(1) Machinery and facilities.

(2) Will of the operator.

Machinery and Facilities.

It is economy to supply the best tools with the best facilities, and among such facilities light stands first. We want to emphasize that point. Light is a tool. It is the most important tool in the industrial plant. It is the tool by means of which all other tools are run.

In equipping his plant, the modern industrial manager spares no expense in the purchase of up-to-date tools and machin-The finest punch presses, the best erv. lathes, the most expensive automatics must all be his. But how about the light-Strange as it may seem, lighting ing? very frequently is an incidental-a matter of secondary consideration.

There will come a time when lighting will be considered first. That time will he when the industrial manager realizes that an efficient lighting installation will earn greater dividends on its cost than any other tool or machine in his entire

plant.

WILL OF THE OPERATOR.

The human machine must have the will to work, as well as the facilities. conscious will is largely the result of wages: the subconscious will depends upon interest in the work, contentment with conditions and physical health. The two latter conditions are largely dependent

upon light.

These statements are true, and must surely appeal to the progressive industrial manager. Yet when you approach him on the subject of a new lighting system, he tells you that they sound good in theory, but he wants to see the dollars and cents side of the question. It's easy enough to produce figures that show a large saving in current by the installation of high efficiency lamps in place of antiquated low efficiency types, but the rub comes when you try to reduce human machine efficiency to dollars and cents. It is the writer's aim during the next year to devote as much time as possible to a comprehensive study of this subject; with the idea of reducing the intangible benefits of good lighting to a definite basis.

In spite of the difficulties referred to, it has been possible to collect the following

interesting and convincing data:

Modern industrial plants have machinery arranged so that raw material is taken in at one end and finished product taken out at the other. There is a natural sequence of operations—that is, working without lost motion. Often the lighting is inadequate, or so poor, that this sequence is broken. That means a tie up of the entire plant and an undisputed waste. Example: An estimate furnished by one of the large paper mills recently indicated that the loss on the output for six minutes is more than the cost of their

lighting for twenty-four hours.

(b) A recent study of shoe factory conditions revealed the fact that they are miserably lighted. Example: A man operating a channeling machine in the sole leather room, told the investigators that he was unable to do any channeling after dusk, so spent his time in grinding knives, etc. This work could have been done by a comparatively low-priced boy.

(c) As night comes on, it is natural for us to relax and slow down in our work. Darkness produces a weariness that we can't overcome. As explained before, ideal lighting is that which merges day into night with the least change in inten-

In poorly lighted factories, bodily fatigue steals over the workman, and, if he continues to work, his efficiency is fur-

ther reduced by eye fatigue.

Pages could be written on eye fatigue, and what it does toward reducing the workmen's efficiency. In a word, it is one of the most powerful and cunning enemies to health and happiness that civilized human beings know.

The question of cost of light is wholly inconsiderable as compared with the efficiency of the workman. Even if used during the entire working hours of the day, it will not represent more than onehalf of I per cent. of the workingman's

wages.

(d) The following experience of a friend of the writer is enlightening:

After leaving college, he entered the shop course of an electrical manufacturer. Daylight conditions in their factory were good, but the artificial lighting was not at

all conducive to human efficiency.

Winding coils on piecework basis, he could earn \$2 per day. Later when changed to night shift he could only earn \$1.10 during the corresponding number of The same conditions held with other men, so that they requested to be placed on hourly pay. They didn't think about efficiency engineering of light that time, and apparently the forem.

didn't because there was no change, and the company continued to run that department at 55 per cent. efficiency. In addition to that he stated that only about 5 per cent, of the coils wound by daylight failed under high voltage insulation test, while 10 to 15 per cent. of those wound at night were returned for rewinding.

He stated that while testing motors and generators, he frequently fell asleep sitting on the bedplate of the machine that he was testing. He was willing and anxious to give the company the best he had in him, but the light was so poor that the eye fatigue simply put him down and out.

Later while in the sales department, he asked the foreman of one of the manufacturing departments to do some night work on rush orders. The foreman stated that he would like to accommodate him, but that the last time he worked nights he found at least a half dozen empty whiskey bottles hidden in the corners. Possibly it was a case of poor light driving them to drink. The same deplorable conditions obtain in many of our industrial plants to-day.

(e) Industrial employees are primarily interested in two things, wages sufficient to properly feed and clothe themselves and pleasant working conditions. lightens labor," and we must admit goes a long way toward furnishing the latter requisite. If we keep our help working at high efficiency, our output in quality and quantity is sufficient to warrant our paying a good livable wage. Good light seems, therefore, to be a panacea for many labor troubles.

THE EFFECT OF GOOD ILLUMINATION UPON SAFETY.

Fig. 1 shows average hours per day of sunshine, cloudiness, and darkness for each month of the year. Fig. 2 shows the seasonal distribution for three successive years of 700 deaths annually from industrial accidents reported from an area embracing 80,000 plants.

In a book entitled "Prevention of Industrial Accidents," published by the Fidelity and Casualty Company of New York, the following statement appears on page 5: "Statistics show that the greatest umber of accidents occur during the hs of diminishing light." A comparison of the above diagrams shows in a very striking manner the relation that good illumination bears to the number of accidents which occur in industrial plants at the present time-almost twice as many during the dark months of December and January as during the light months of June and July. These two charts can mean only one thing: that at the present time proper illumination is not furnished to safeguard suits against accidents.

The Manufacturers' Association states that in the United States alone 500,000 avoidable accidents have occurred in one year, and it is claimed by the authorities who have made a study of safeguards for the benefit of employees that 25 per cent. of these accidents were caused by poor illumination. Now, while a good deal is being said in regard to suitable safeguards to protect lives and limbs of employees, it is time that some definite step is taken towards the adoption of good illumination, as one of the economical safeguards

against accidents.

The above charts and the statement coming from one of the largest insurance companies should sufficiently impress industrial managers with the fact that a suitable amount of light is as essential to the safety of their employees as any of the safeguards that have already been applied to belts, pulleys, etc. The costs and damages incurred by these accidents, when added to the lighting bill as they rightly should be, increase it out of all proportion to the cost necessary to prevent such accidents through the medium of good illumination. Every mill owner and operator has had his own little experience along this line. Therefore, nothing more need be said regarding the necessity of taking every step possible for the future protection of himself financially and his employees physically.

Aside from the humanitarian phases of this question, industrial plants will find themselves in a most embarrassing position when employers' liability acts (such as was recently passed by the New Jersey Legislature) are enacted generally

throughout the United States.

AVAILABLE LIGHTING UNITS.

Electric lighting is considered standard for all industrial purposes.

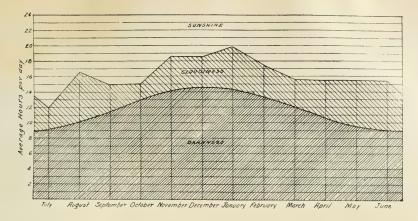


FIG. I.

Two general classes, incandescent lamps and arc lamps, are available, and may be outlined as follows:

 $\begin{array}{c} Incandescent \ lamps \\ & Mazda-tungsten, \\ & Arc \ lamps \\ & Arc \ lamps \\ & Luminous. \\ \end{array}$

Carbon incandescent lamps and enclosed carbon arc lamps were standard for industrial lighting from the early nineties to about 1907. About that time high efficiency incandescent lamps made their appearance and have been growing in popularity ever since.

Even though many of the older forms are still being sold and used, it can well

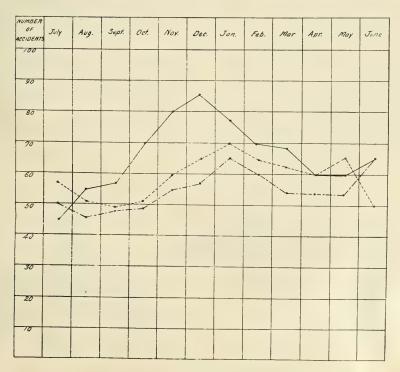


FIG. 2.

be said, for the purpose of this paper, that two forms of electric illuminants are now standard:

High efficiency incandescent (Mazdatungsten) and high efficiency arc lamps

(flame and luminous).

So much of a convincing nature has been said and written about the saving in current cost by using high efficiency units over low efficiency that it would be superfluous to enter into a detailed discussion of their respective merits. We are safe in assuming, however, that wherever the current cost is one cent per K. W. hour or above it will be economical to install high efficiency lamps.

Neither will space permit a detailed outline of the relative operating cost of incandescent lamps and arc lamps. The selection of either form of illuminant depends upon the nature of the work to be done. Both have their place and when it comes to relative operating cost it is a Incandescent lamp adherents toss-up. claim that the Mazda-tungsten has lower operating cost than arcs, while arc lamp adherents claim that the flame and luminous arcs are more economical. doctors disagree the industrial managers must decide. Technically, however, both are correct, because, as will be outlined in a later chapter, both have a definite function to perform, and in many cases, the two lines dovetail.

With the development of high efficiency lighting units it became necessary to deal with light sources having higher candlepower. The units had to be spaced farther apart, they had to be suspended at greater heights, and, above all the extremely brilliant light sources had to be covered to prevent injury to the eyes of those working beneath.

Reflectors of different forms were developed, not only to protect the operators' eyes, but to direct the light where it was most needed. For commercial lighting glass reflectors are standard, while for industrial purposes steel reflectors are most commonly used.

LOCATION AND SPACING OF UNITS.

This subject at once suggests the three general classes of industrial illumination:

- 1. General illumination.
- 2. Specific illumination.
- 3. Composite illumination.
- 1. The first class is used where a more or less even intensity of light is desired over the entire floor area. For this class of lighting high candle-power incandescents, 150 candle-power and up, or high candle-power arc lamps should be used.
- 2. The second class deals with individual lighting or where a higher degree of illumination is desired at the working plane than would be practical or economical for the entire floor area. Specific illumination is provided by installing low candle-power units applied directly to the various types of machines as, for example, lathes, sewing machines, silk knitting machines, etc.
- 3. Composite lighting embodies both the general and specific where low candlepower units are employed for close work



FIG. 3 .- ABOLITES -- SCIENTIFIC STEEL REFLECTORS.

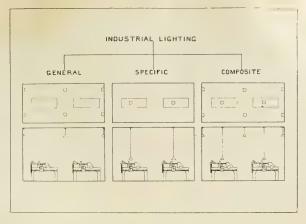


FiG. 4.

and high candle-power units to light the entire areas.

General illumination or composite illumination will be found to cover most industrial conditions. General illumination is most economical and should be used wherever practicable. By avoiding specific illumination it is possible to reduce wiring costs, unsightly drop-cord suspensions, and the lighting unit is not subjected to handling and arrangement by operators. This latter prevent three things:

1. Breakage of lamps;

2. Soiling and breakage of reflectors;

3. Time wasted by operators in adjusting and handling the drop light.

It is impossible in limited space to treat the subject of spacing and location of units in more than a general way and point out a few concrete examples of good practise, including some general rules that may be followed to advantage.

Let us take, for example, high-studded rooms, such as erecting bays, locomotive works, shipbuilding plants, iron and steel foundries, center bays of machine shops and the like. In such places the most satisfactory and economical results may be obtained by the use of large high candle-power units placed above cranes, and as far out of the normal line of vision as possible. In such cases it is necessary to use more or less concentrating reflectors in order to cut out the waste light on the side walls and raise the foot-candles on the working level. By large units, we refer to flame arcs, luminous arcs, 500-watt

Mazda-tungsten, in fact any high efficiency unit having a current consumption of approximately 500 watts.

Rooms of moderate height ranging from 12 to 15 feet, such as we find in cotton, wool, silk and similar mills, small machine shops or machine shop galleries, clothing manufacturing establishments, etc., can be lighted to advantage with either large or small units, or a combination of both, depending upon local conditions. Where the studding is relatively low, say less than 12 feet, small units, such as the 100, 150 and 250-watt Mazda-tungsten lamps, usually give the best results.

In every case preference should be given to the largest possible unit consistent with sufficiently good distribution for the particular purpose. By minimizing the number of lamps, we cut down the cost of wiring, switching and the maintenance cost of the units.

Briefly, the relative cost list price, 1300 hours' life of five 100-watt lamps on a 4000-hour year is \$20.76, while the cost of one 500-watt lamp for the same period is \$16.92, showing a saving of approximately 24 per cent. In all cases, the lamps should be properly reflectored, placed as high as possible and every effort should be made to shield the direct light from the eyes of the operators, without, of course, sacrificing too much in foot-candles on the working level.

The location of lighting units can be summarized as follows:

I. Large units for high-studded rooms, small units for low-studded spaces.

2. Place lamps above the crane and always as high as conditions permit, using in every case suitable reflectors.

3. Select the largest lamps consistent with sufficiently good distribution for the

particular purpose.

4. Where the floor space is large and the work rough, use moderate general illumination, and for the same condition, with fine work, add local lights at the tools. Where there are a great number of small machines in a relatively small space, general illumination should be used. For processes on machines turning out particularly fine work individual lights will probably be required.

5. Protect the employees as much as possible from direct rays of light. "Light

on the work, not in the eyes."

Fig. 5 gives the following data on the lighting of the plant of a large electrical manufacturer:

- 1. Ceiling or girder line height.
- 2. Character of surroundings.
- 3. Size of lamp.

4. Spacing distance.

- 5. Mounting height above floor.
- 6. Watts per square foot.

7. Class of work.

Manufacturing conditions vary so greatly that it is impossible to establish definite rules covering all installations. Each installation should be handled on its merits, and it should be handled by a competent illuminating engineer. When

the human eyesight is defective, we consult a competent specialist. When our factory eyesight is defective, we should consult an experienced light specialist.

TABLE OF FOOT-CANDLE INTENSITIES RECOMMENDED FOR VARIOUS CLASSES OF SERVICE.

		TTT-:4: 20
Arcade (in addition		Waiting room 2.0
to light from		Drafting room 8.0
show windows).	1.0	Engraving10.0
Armory	2.0	Factory—
Ant collors (walls)	5.0	Factory— General lighting
Art gallery (walls) Auditoriums	$\frac{3.0}{2.0}$	(where individ-
Auditoriums	2.0	ual drop lights
Automobile-		are provided) 1.5
Garage, large	2.0	are provided) 1.5
Garage, small	1.0	General lighting
Showroom	5.0	General lighting (where no indi-
Storage room	1.0	vidual lights are
Ball room	2.0	provided) 4.0
Ball room		Local bench illu-
Bank (general)	3.0	mination 4.00
Bar room	2.5	Tring stations
Barber shop	3.0	Fire stations—
Bath (public)—		At alarm 3.0
Dressing rooms	1.0	At other times 1.0
Swimming pool	2.0	Foundry 3.0
Dillhaand	8.0	Garage 2.0
Billboard	0.0	Gymnasium 2.5
Billiard room-		Hallways
General	1.0	
Table	5.0	Hospital—
Bookkeeping	5.0	Corridors5
Bowling alley—	0.0	Operating table. 12.0
	1.0	Wards (with no
Alley	4.0	local illumination
Pins		supplied) 1.5
Runway & seats	1.5	Wards (with local
Cafe	2.5	
Card room (tables).	2.0	illumination sup-
Carpenter shop-		plied)5
General	2.5	Hotels—
Machinery	4.0	Bedroom 1.5
Cars	T .0	Corridor 1.0
	10	
Baggage	1.0	
Day coach	2.0	Lobby 2.0
Dining	2.0	Writing room 3.0
Mail	7.0	Lavatory 3.0
Pullman	2.0	Laboratory 3.0
Street	2.0	Laundry 2.0
Corridors	.6	Library—
	.0	
Courts—	= 0	Stock room 1.5
Handball	7.0	Reading room
Squash	7.0	(with no local
Tennis	7.0	illumination sup-
Courtroom	2.0	plied) 3.5
Church	2.0	Reading room
Dance hall	2.0	(with local illu-
	2.0	
Depot-	1.0	mination sup-
Baggage room	1.0	plied) 1.0
Train sheds	1.0	Lodge room 2.5

	D.	A'TA OF	MAZDA	TUNG	STEN I	LAMP	INSTAL	LATIONS.	
Ceiling of Girder Li Height.			Size Lar		acing D	istance.	Heigh	ng Watts pe at Square oor. Foot.	Class of Work.
			M.	ANUFAC:	TURING	SPACES.			
8' 1" 9' 0" 11' 1" 11' 9" 11' 9" 12' 0" 12' 0" 12' 0" 12' 6" 13' 8" 16' 0" 16' 0" 16' 0" 16' 0" 16' 0" 16' 0" 24' 9"	" " 1	lark ", no " and " and " and " lark wa ight " lark wa " no wa	lls 60 w 100 100 100 100 100 100 100 100 100	7att 66 66 66 66 66 66 66 66 66 66 66 66 6	8' 0" x 10' 0" x 10' 0" x 10' 0" x	8' 8' 0'' 8' 8' 6'' 8' 8' 9'' 8 8' 9'' 8 8' 9'' 8 8' 0'' 8 8' 0'' 8 8' 0'' 8 8' 0'' 8 10' 0'' 8 12' 0'' 8 12' 0''	7' 6 8' 6 10' 3 11' 0 11' 3 11' 3 11' 3 11' 3 11' 3 12' 10 14' 6 15' 2 15' 2 15' 2 21' 2	'' 1.61 2'' 1.30 2'' 1.23 2'' 1.76 2'' 1.18	Winding Work Bench Work—flat Bench Work Machining Machine Work """ Bench Work Machine Work Winding Work Rough Work Painting Machines Fine Die Work Bench Work Fine Ass'bly Work
24' 0" 24' 9" 25' 2"	"	66 6	$\frac{250}{250}$	44	11' 0'' x	$12'\ 0'' \ 12'\ 0'' \ 12'\ 0''$	21' 3	2.00 '' 1.66 ''' 2.35	Machine Work Testing

FIGURE 5 .- TABLE.



- FIG. 6.—WINDING DEPARTMENT, SILK MILL.

The twenty crow winders of the soft silk department are lighted in groups of two. One 60-watt Mazda lamp, with intensive steel reflector, is placed half way between each two machines at a uniform height of 7 ft. 6 in. above the floor.



FIG. 7.—WARPING DEPARTMENT, SILK MILL.

Three units, consisting of 60-watt Mazda lamps and intensive steel reflectors, are used for each machine. One unit is placed on the bobbin rack, one in front of the reel and one at the rear. The mounting height of the units is 7 ft. 6 in. above the floor. The entire length of the warp is uniformly lighted.



FIG. 8.—WEAVE SHED, SILK MILL.

The weave room is divided into two parts, each occupying one-half of the second floor. In each, there are 200 looms. Fig. 8 shows one aisle in each of these halves. The lighting of the looms is accomplished by placing one 60-watt Mazda lamp equipped with intensive steel reflector over the loom in the space between the lathe and the harness. A second unit is suspended in the warp alley, midway between the backs of two adjacent looms. In this way these looms are lighted by two 60-watt lamps. The height of the lamps is 7 ft. 6 in. above the floor.



FIG. 9.—THE OHIO LAMP WORKS OF THE NATIONAL ELECTRIC LAMP ASSOCIATION, WARREN, OHIO,
LIGHTED WITH GO AND 100-WATT MAZDA LAMPS, FITTED WITH INTENSIVE
ENAMELED STEEL ABOLITES.



FIG. 10.—PLANT OF THE N. J. RICH COMPANY, CLEVELAND.

The largest fancy knit goods mill in the world, lighted with 60 and 100-watt Mazda lamps, fitted with intensive enameled steel Abolites.

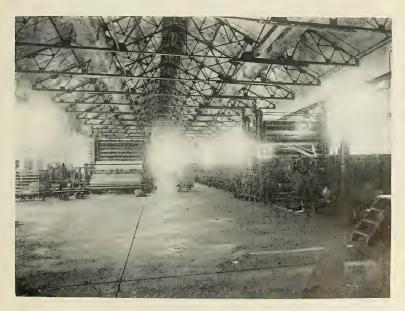


FIG. II.—THE MARATHON PAPER MILLS, WAUSAU, WIS., LIGHTED BY REGENERATIVE FLAMING ARC LAMPS.



FIG. 12.—YORK SAFE & LOCK COMPANY, YORK, PA., LIGHTED BY REGENERATIVE FLAMING ARC LAMPS.



FIG. 13.—THE CRANE VALVE COMPANY, BRIDGEPORT, CONN.

This room, 352 ft. long by 50 ft. wide, 17,600 sq. ft. floor space, is lighted exclusively by ten regenerative flaming arc lamps. Lamps are suspended 32 ft. 6 in. above the floor and fitted with cone reflectors. This building is ideally lighted with the remarkably low power consumption of 5 kw.

Lunch room 2.0	Stereotyping 4.0
Market 3.0	Stock room 1.0
Mechanical work	Store-
(fine) 5.5	Art 4.0 Baker 3.0
Moving picture	Baker 3.0
theatre 1.5	Book 3.5
Musculli	Butcher 3.5 China 2.5 Cligar 3.0 Clothing 6.0 Clothing 6.0 Cloak and suit. 5.0 Confectionery 3.0 Decorator 3.0 Department (see
Office—	Cioran 3.0
File room3.0 Desk4.0 General (no drop lights)4.0	Clothing 6.0
Conoral (no dron	Clock and suit 5.0
lights) 4.0	Confectionery 3.0
	Decorator 3.0
lights) 1.5	Department (see
Vault (safe) 3.0	Cach acpare
lights) 1.5 Vault (safe) 3.0 Vault (storage) . 1.0 Pattern shops 4.0	ment).
Pattern shops 4.0	Drugs 3.0
Pool room(general) 1.0	Dry goods 4.0
Pool table 5.0	Florist
Power house 2.5 Postal service 7.0	Furniture 5.0
Press room 4.0	Greery 3.0
Power nouse	Drugs 3.0 Dry goods 4.0 Florist 3.0 Furniture 5.0 Furrier 5.0 Grocery 3.0 Haberdasher 5.0 Hardware 4.5
print) 2.0	Hardware 4.5
Reading (fine	Hat 4.0
print) 2.5	Jewelry 3.5
	Hat 4.0 Jewelry 3.5 Lace 3.0 Leather 3.5 Most 3.5
Porch	Leather 3.5
Porch (reading	
light) 1.0	Men's furnishings 3.5
Hall (entrance)7 Reception room. 1.5	Millings 4.0
Parlor 1.5	Millinery 4.0 Music 3.0
Parlor 1.5 Living room 1.5	Notions 3.0
Library 2.0	Piano 4.0
Music room 2.0	Post cards 3.0
Dining room 1.5	Shoes 5.0
Pantry 2.0	Stationery 3.5
Kitchen 2.0	Stationery 3.5 Tailor 4.0 Tobacco 3.0
Dining room 1.5 Pantry 2.0 Kitchen 2.0 Laundry 1.5	Tobacco 3.0
Hall (upstairs)5 Bedroom5 Bathroom 2.0	Street—
Bedroom 2.0	Business (not including light from show win-
Furnace room5	from show win-
	dows and signs) .5
Restaurant	Country roads0.05
Rink (skating) 2.0	Prominent (in
Rug rack15.0	Prominent (in residence dis-
Saloon 3.0	tricts)2 Residence1
School-	tricts)
Assembly room. 2.0 Classroom 2.5	Telephone exchange
Assembly room. 2.0	(general) 3.0
Corridor	
Corridor	Anditorium 2.0
Laboratory 3.0	
	Typesetting 8.0
Office 2.5	Typesetting 8.0 Warehouse 1.0 Wharf 1.0
Study room 2.5	Wharf 1.0
Office 2.5 Study room 2.5 Sewing (light goods) 4.0 Sewing (dark goods) 8.0 Schipping room 15	Weaving—
Sewing (dark goods) 8.0	Cotton, light colors 2.5
Shipping room 1.5	Cotton, dark
Dark goods 200	colors 4.0
Light goods 8.0	Wool, light colors 3.0
Medium goods,16.0	Wool, dark colors 5.0
Sign 8.0	Silk, light colors. 4.0
Show window	colors 2.9 C o t t o n, dark colors 4.0 Wool, light colors 3.0 Wool, dark colors 5.0 Silk, light colors. 4.0 Silk, dark colors. 6.0
Stable 1.0	
~	

Conclusion.

The aim of this article has been to show four things:

1st. That efficient artificial illumination is necessary.

2nd. That there are lighting units available for this purpose.

3rd. The application of these units to produce the desired results.

4th. The effect obtained by their use.

In conclusion we should like to call attention to the possible saving in industrial operation by the proper application of efficient scientific illumination.

Two hundred and fifty thousand industrial plants in the United States have an annual output of twenty billion dollars. Available data shows that an efficient lighting system increases the output from 2 to 15 per cent. (2 per cent. in steel mills to 15 per cent. in textile mills and shoe factories). To be ultra-conservative we will say that there is a saving of only 2 per cent, in the annual output of the manufacturing plants of the United States. This means an annual saving of four hundred million dollars. This enormous sum represents the saving on actual production only, and leaves us to conjecture what the saving would be if we took into consideration the improved quality of output and the saving due to decrease in deaths and accidents. Deducting the first cost of installation and maintenance, still leaves an almost incredible amount.

Louis Brandeis testified before the Interstate Commerce Commission, Washington, that by scientific management the railroads of the United States could effect a saving of one million dollars per day. A careful perusal of the figures given above shows a saving of more than a million dollars per day by an application of the principles of efficiency engineering of light to the industrial plants of the United States.

A portion of the matter embodied in this article was used by the writer in an address before the Cleveland branch of the American Institute of Electrical Engineers.



An Electric Church Sign

How a Chicago Church Has Made Use of the Electric Sign to Attract Strangers to Its Doors

By A. R. GIBBONS

With the development of the institutional features of Trinity Parish House, the Reverend John M. McGann, Rector of Trinity Episcopal Church, Chicago, found himself in a peculiar situation. The Parish House, a beautiful Gothic stone structure, stands adjoining Trinity Church on Twenty-sixth Street at Michigan Bou-

levard, in what was a decade ago the most exclusive residence district in Chicago. Within a few blocks were the mansions of the city's most famous and influential residents and among Trinity's parishioners are many families prominent in the development and fame of Chicago.

At its best, Twenty-sixth Street is poor-



FIG. I .- DAY VIEW OF SIGN, SHOWING ORNAMENTAL EFFECT.



FIG. 2.—NIGHT VIEW OF NEW ELECTRIC SIGN ON TRINITY PARISH HOUSE, CHICAGO.

ly illuminated by the few lamp-posts that did duty when it was a quiet residence side street. The location of the Parish House almost required a chart and compass after dark; certainly it did not attract or invite any one to its doorway. Light was needed, and the idea of employing an electric sign to mark the entrance was evolved.

Photographs of the building were sub-

mitted to architects, Lowe and Bollenbacher, who prepared a design, the simple Gothic dignity of which blended in architectural detail with the building, and yet did not lose its force and legibility so necessary in an electric sign.

The sign itself was then cast in solid metal from molds made from the architects' drawings. The faces of the raised Gothic letters and of the cross, which measures two feet high, were made of white porcelain enameled steel. At each end the words PARISH and HOUSE in milk-white leaded art glass upon an amber background were illuminated from the interior and blend in pleasing harmony with the bronze surface of the sign. Massive bronze chains and square bronze rods support the sign, necessitating the piercing of the stone wall two feet thick for a secure anchorage.

One hundred and eighty frosted carbon lamps illuminate the letters, and the general effect of this golden flood of light is indescribably beautiful. The sign can be read for two blocks in either direction, and the outline of the cross for five blocks. as far as one can go before the direct view is shut off. Although only nine and onehalf feet long and four feet high over all, the Trinity sign is probably the most beautiful and distinctive electric sign of its class ever built. It marks the advent of electricity into ecclesiastical usefulness in a manner that does credit to the makers and sounds a new note in the architectural possibilities of electric sign building.







"Streets Too Dark"

Press on All Sides Reports Discontented Citizens Howling for More and Better Light

As any average American traveling about the country knows, there is to-day no one single topic of discussion in the public press, along lines of civic improvement, to which more space is given than "Lighting Up."

It may be that you will take up a paper published in a little town—or it may be one of the metropolitan dailies. It is the same story—everybody demanding

more light.

To put it simply, this movement for better ornamental street lighting, in business as well as in the residential sections, is accepted as a matter of course as one of

the first necessities.

To analyze this situation is not uninteresting. Merchants of town A have their own local trade; not far away the merchants of town B have their own local trade. However, there is always a fight between adjacent towns for the "middle ground" business. If town A lights up, town B immediately feels handicapped, and indeed it is handicapped. To overcome the handicap town B proceeds to go town A one better. Such is the gist of the street lighting movement generally.

In addition to this continuous competition, however, often the slowest, the most indifferent citizens are pretty sure to admit that good lighting actually increases business—stimulates people to buy and want more. Cities become to an extent promenade grounds for the leisure hours, after the majority of people are through with their work. With better light, they dress better, eat more, want more entertainment, and lead a livelier exist-

ence.

Baltimore, with its soon coming National Democratic Convention, saw at once that it needed some ornamental lighting to advertise its city and make the visiting legions feel at home. Along the line of reasoning which has, to Baltimore's credit, been followed during the reconstruction since their disastrous fire,

she decided that it was wisdom to put in decorative and permanent lighting. Accordingly, Baltimore will install along some of her principal streets about 250 ornamental standards especially designed to look right by night or day, with G. E. Luminous arcs. Perhaps the moralist will observe that it is but one more sign of the movement afoot to throw more light upon politics.

The Fifth Regiment Armory, where the Democratic convention is to be held, and several other buildings will be ornamentally illuminated with festoons of

lamps and what-not.

There are so many cities which have sent delegates to New Haven, Conn., to make formal and official investigation of the recent installation there, that New Haven has received great and valuable advertising, not to mention the actual increase in local business.

Waterbury, Conn., has for some months been taking up the matter of ornamental street lighting, and as a beginning proposes to transform the village green at night from a place of darkness to a "Place De Luxe." Commissioners Koch and Moore have considered the recommendation for 24 ornamental 5light electroliers to be installed about the green, using what seems to be the generally acceptable arrangement of 40-watt tungstens for the arms with 100-watt tungstens for the center. The United Electric Light and Power Company has co-operated with the commissioners to arrange matters satisfactorily for all concerned. Another New England town-Haverhill, Mass.—is getting nervous on account of having too little light and complaining that on moonlight nights the gas lights "don't burn at all," so that the city is not only in shadow and darkness, but that darkness is made more intense occasionally by clouds that will insist upon obscuring the "Queen of Night." What they want is the all-night service, moon or no moon,

New England is indeed waking up to the importance of exterior illumination, both ornamental and practical, for business purposes and for the residential sections. New England towns have not had the reputation of being what could be called leaders in the modern street lighting movement; and, indeed, if the truth be told, there are quite a number of good New England cities that need better lighting and need it badly.

Asbury Park "bids fair to soon become the greatest White Way on the Jersey coast," says the "Press," of that famous resort. The boardwalk properties, with several proprietors of amusement places in the lead, have taken steps to make the promenade more cheerful than ever.

Geneva, N. Y., owing to the leadership of W. H. Hoefler, has formed an organization specially to promote the cause of ornamental lighting. Exchange Street is to become the great White Way, the merchants on this street having organized a street improvement society. Seneca and Castle streets are doing likewise, and Geneva will soon be getting itself talked about just as New Haven and many other cities have.

At Trenton, N. J., the Street Planning Commission, the Chamber of Commerce and the merchants' committee are working with the Public Service Corporation of N. J. to settle upon definite arrangements for lighting up several of the business streets with ornamental lampposts. Wires have been taken down,

and the people are very proud.

At Phoenixville, Pa., the light committee is exhibiting for the benefit of citizens a display of tungsten lights, according to the "Republican," published in that city. To quote further from this publication, "instead of the one-arc lights on several corners, the place is to have groups distributed along the block." It looks as if the "corner arc-lamp" is getting passé with Phoenixville-one of the latest to give it the good-bye.

Cincinnati, Ohio, is to have a very material extension of boulevard lighting in the down town district. Seventy thousand dollars have been laid out for the purpose, of which the property owners are required to pay \$42,000. Resolutions were adopted by council recently for a number of streets, with more to come.

Dubuque, Iowa, which is known all over as being one of the most progressive cities in the country for lighting up its business sections, has now turned its attention to installation of boulevard light-

ing systems in the parks.

The success of the New Haven, Conn., installation has reached the ears of the people of Lockport, N. Y., and they are eager to arrange for their own community a similar system. The aldermanic committee recently visited New Haven to fully investigate and report.

At Ottawa, Canada, Mayor Hopewell is leading the movement, and is urging a petition for a White Way on Bank Street, to extend from Gladstone Avenue

to the Exhibition Hall.

At Kingston, N. Y., boulevard lights on Court Street have been connected up with the trolley system of the Binghamton Railway Co. The cable for the commercial lighting portion will replace the wires and the unsightly poles, along with the wires of the telephone company.

Paducah, Ky., is considering making its Broadway worthy of the name with

ornamental street lighting.

As an instance of "wanting more," the business men of Main Street, Fort Wayne, Ind., want the ornamental lighting system extended to Ewing Street. So it goes.

EDITORIAL

Progress of Better Lighting in the Cloak, Suit and Skirt Industry in New York

We have noted in these columns on several previous occasions the excellent work of the Joint Board of Sanitary Control in the Cloak, Suit and Skirt Industry in improving the sanitary conditions of the workshops in this city. So far as we know, this is the first organized effort on the part of union labor to establish a definite code of sanitation, and maintain the requisite inspection to insure its being carried out. The last Bulletin of the Joint Board, bearing date of May, 1912, contains the following paragraph:

"Progress in protecting the worker from eye strain is shown in the fact that the shops unprotected from glare have been reduced from 83 per cent, in the first inspection to 72 per cent, in the second,

and 51 per cent. in the third."

The first inspection was made previous to the establishment of the Sanitary Code, and was conducted as an investigation to determine existing conditions. The second inspection was made one year later, and the third inspection six months after

the second inspection.

The figures above quoted, therefore, signify that practically one-half of the shops now have artificial lighting so arranged that the eyes of the operators are entirely shielded from the direct rays of the light sources, and that the number of shops in which there was objectionable glare has been reduced one-third in eighteen months. This is indeed most highly satisfactory progress, and shows how effective co-operation between organized employers may become in promoting better physical conditions for the workers.

The Growing Service of the Central Station Industry

The day seems to have gone by when

business comes in of its own accord.

Perhaps there is no better illustration of this fact than the general attitude of the Central Station man toward the public. As conventions have passed by, year after year, there has been a rapid and steady increase of attention on the part of Central Station managements to the opportunity—for opportunity it is of going out after business. thought the old-time notion of simply supplying the current and letting the consumer use it (or abuse it) as he might, can be included in the long and growing list of bygone conditions; from which, perhaps, we sometimes speak of those " far off fields that look green."

Underneath this disposition to go after the business there lies a growing appreciation of giving good service. The business that comes in of its own accord, it seems now generally acknowledged, is held too cheaply. And, being held so cheaply, there has been no desire on the part of the consumer, as well as the Central Station, to co-operate by each side appreciating the position of the other.

So, with this new order of things, one might well ask himself at this National Electric Light Association convention: Where is the limit to the service which the Central Stations can render the people—if there is any limit?

So far as lighting is concerned, conditions have greatly changed within recent years. There is no phase of this feature of Central Station advancement that is not open to virtually unlimited development. People appreciate good light whether for home, civic, industrial or commercial life.

Look back but a few years, and then picture to yourself what but a few years hence may bring forth in the way of improvements.

TECHNICAL SECTION

SOCIETIES

Business Programme for the Seattle Convention of the National Electric Light Association.

A review of the programme for the forthcoming convention of the National Electric Light Association shows that those who attend will find themselves pretty busy. The convention begins on the evening of June 10, with a reception

and the opening of the exhibition.

It will be remembered at the last convention held in New York there was no exhibition. By and large, the omission of the exhibition seemed to meet with disappointment and disapproval; many of the visitors claim that they attended conventions to be instructed by looking at things as well as through papers and discussions. Inasmuch as most of the central station men of the country believe in educating their consumers to use up-to-date appliances by means of demonstration, it would seem no more than reasonable that they would be prepared to take their own medicine from the several manufacturers who believe that the exhibition of their appliances is of value, both to the central stations buyers and themselves.

The programme of the convention follows:

GENERAL, EXECUTIVE, TECHNICAL, ACCOUNTING, COMMERCIAL, POWER TRANSMISSION AND PUBLIC SESSIONS.

TUESDAY, IO A.M.

ROOM.

First General Session.

I—Welcome to the City; 2—Address of President Gilchrist; 3—Announcements; 4—Report of Committee on Organization of the Industry—H. H. Scott; 5—Report of Secretary—T. C. Martin; 6—Report of Insurance Expert—W. H. Blood, Jr.; 7—Report of Committee on Progress—T. C. Mar-

tin; 8—Report of Library Committee, Report of Handbook Committee—Arthur Williams; 9—Report on Question Box—E. A. Edkins; 10—Paper: Expanded Loyalty—Paul Lüpke.

TUESDAY, 2.30 P.M.

ROOM.

First Commercial Session.

I—Address of Chairman of Section—H. J. Gille; 2—Address: Commercial Development of the Electrical Industry—W. W. Freeman; 3—Report of Committee on Membership—George Williams; 4—Report of Committee on Steam Heating—S. M. Bushnell; 5—Report of Committee on Electric Refrigeration and Ventilation—John Meyer.

Tuesday, 2.30 P.M.

ROOM.

First Accounting Session.

I.—Report of Committee on Uniform Accounting—E. J. Bowers; 2—Paper: Incandescent Lamp Accounting of the New York Edison Co—W. H. Bogart; 3—Paper: Handling and Accounting for Scrap Materials—Chas. E. Bowden; 4—Paper: General Filing Systems—R. H. Williams.

TUESDAY, 2.30 P.M.

ROOM.

First Technical Session.

I—Report of the Meter Committee—O. J. Bushnell; 2—Paper: Meter Setting—S. D. Sprong; 3—Report of Committee on Grounding Secondaries—W. H. Blood, Jr.; 4—Report of Lamp Committee—F. W. Smith; 4—Report of Committee on Electrical Measurements and Values—Dr. A. E. Kennelly (to be read with Lamp Report); 5—Paper: Line Voltage—R. E. Campbell.

TUESDAY, 8.30 P.M.

ROOM.

First Power Transmission Session.

I.—Address of Chairman—Henry L. Doherty; 2—Report: The Use of Electricity for Irrigation and Agricultural Purposes— C. H. Williams (illustrated by lantern slides and motion pictures).

TUESDAY, 8.30 P.M.

ROOM.

Second Commercial Session.

I-Report of Committee on Residence

Business—J. F. Becker; 2—Report of Committee on Industrial and Commercial Lighting—E. H. Beil; 3—Report of Committee on Competitive Illuminants—F. H. Golding; 4—Report of Committee on Electric Advertising and Decorative Street Lighting—W. H. Hodge.

Wednesday, 10 a.m.

Second General Session and Executive Session.

I—Report of the Rate Research Committee—E. W. Lloyd; 2—Paper: The Desirability as a Central-Station Load of Pumping for Municipally Owned Water-Works—Chas. A. Munroe; 3—Paper: Educating Central-Station Employees—H. E. Grant. (To be discussed in Company Section meeting, Thursday, P. M.)

Executive Session (12 or 12.30).

I.—Action on Report of Public Policy Committee—Arthur Williams; 2—Presentation of Proposed Constitutional Amendments—Frank W. Frueauff; 3—Report of Treasurer—G. H. Harries; 4—Election of Nominating Committee.

Wednesday, 10 a.m.

ROOM.

Second Technical Session.

I—Report of the Committee on Terminology—W. H. Gardiner, Jr.; 2—Paper: New Current-Consuming Devices—F. N. Jewett; 3—Paper: 24-Hour Service in Small Central Stations—Taliaferro Milton; 4—Report of Committee on Overhead Line Construction—Farley Osgood.

Wednesday, 10 a.m.

ROOM.

Second Accounting Session.

I—Paper: Proper Accounting for the Sale of Electric Devices—L. M. Wallace; 2—Paper: Scientific Management of an Accounting Department—Franklin Heydecke; 3—Paper: Central-Station Motor Vehicle Costs and Their Distribution to Accounts Benefited—E. C. Scobell.

WEDNESDAY, 2.30 P.M.

ROOM.

Second Power Transmission Session.

I—Paper: Work and Publications of the U. S. Government Relating to Hydro-Electric Development—J. S. Hoyt; 2—Report of Power Transmission Committee of the Association—J. R. McKee; 3—Report of Committee on Power Transmission Progress—T. C. Martin; 4—Paper—Switchboard Practise for High-Tension Power Transmission—Stephen Q. Hayes.

WEDNESDAY, 2.30 P.M.

ROOM.

Third Commercial Session.

I—Report on Electric Vehicles—L. R. Wellis; 2—Report: Electricity in Rural Districts—J. G. Learned; 3—Paper: A Plan for

Increasing Power Load—H. W. Cope; 4—Report: Selling Current to Larger Power-Users—Joseph Lukes.

WEDNESDAY, 2.30 P.M.

ROOM.

Third Accounting Session.

I—Paper: Regulated Electric Light Accounting—H. M. Edwards; 2—Paper: Progress Made in the Uses of the Tabulating Machine—Mr. Schmidt, Jr.

Wednesday, 8.30 p.m. Public Policy Session.

I—Musical Programme; 2—Reading of Report of Public Policy Committee—Arthur Williams; 3—Report of the Medical Commission of Resuscitation from Shock—W. C. L. Eglin; 4—Lecture: Electrification of the Panama Canal (illustrated by lantern slides).

THURSDAY, IO A.M.

ROOM.

Fourth Commercial Session.

I—Report of Committee on Cost of Commercial Department Work—E. L. Callahan; 2—Report of Committee on Contract Order Routine—T. I. Jones; 3—Report of Committee on the Commercial Index—E. L. Callahan; 4—Paper: Ozonators and Their Exploitation by the Central Station—M. O. Troy.

THURSDAY, IO A.M.

ROOM.

Third Technical Session.

I—Report of Committee on Prime Movers—I. E. Moultrop; 2—Report of Committee on Electrical Apparatus—L. L. Elden; 3—Report of Committee on Underground Construction—W. L. Abbott; 4—Paper: Care and Operation of Transformers—W. M. McConahey.

THURSDAY, 2.30 P.M.

ROOM.

Third Power Transmission Section.

I—Report of Committee on Receiving Apparatus for Use on Transmission Lines—F. B. H. Paine; 2—Paper: Corona on High-Tension Lines—G. Faccioli; 3—Report of Committee on Protection from Lightning and Other Static Disturbances—S. D. Sprong; 4—Topical Discussions (time permitting).

THURSDAY, 2.30 P.M.

ROOM.

Third General Session and Executive Session.

I—Paper: Some Uses of Metals—Dr. W. R. Whitney; 2—Report of the Committee on Street Lighting—John W. Lieb; 3—Report of the Committee on Memorials—T. C. Martin; 4—Report of the Committee on Constitutional Amendments—Frank W. Frueauff; 5—Vote on Constitutional Amendments; 6—Report of Nominating Committee; 7—Election of Officers; 8—Adjournment.

Thursday 3 p.m.

ROOM.

Company Sections Session.

I—Report of Committee on Award of Doherty Gold Medal—W. W. Freeman; 2—Discussion of Grant Paper; 3—The Proposed Company Section Lecture Bureau—T. C. Martin; 4—Experience Meeting as to Company Section Work.

Illuminating Engineering Society

"The Testing of Incandescent Electric Lamps" was the subject of the talk given by W. M. Skiff, of Cleveland, at the meeting of the New York section held April 11, explaining interestingly the methods employed at the laboratories of the National Electric Lamp Association. A point brought out was the careful method of checking, by means of which the observer making the error was "set back," while the man who detected the error was credited one-thus creating an incentive to the highest possible accuracy. L. C. Porter, Harrison, N. J., detailed a number of tests made on steam vessels of various kinds-ferry boats, coast line steamers, and transatlantic boats. The results showed remarkable variation throughout.

Henniger discussed "Window Lighting" before the Chicago section which held its April meeting on the 18th at the Great Northern Hotel. Nominating Committee reported the following for the section for next year: Chairman, Prof. W. E. Barrows, Armour Institute; secretary, T. E. Aldrich, National X-Ray Reflector Company; managers, Messrs. F. A. Vaughn, consulting engineer, Milwaukee; S. E. Church, Sears, Roebuck & Co.; John W. Foster, Holophane Company; Edward Wray, of the Railway Electrical Engineer, and J. R. Cravath, consulting engineer.

At the April meeting of the Boston section of the society, Norman Macbeth presented a paper on the subject, "Competition in Illuminants from the Standpoint of the Salesman." Mr. Macbeth brought out the point that a close watch should be kept on all installations to see that merchants should be given the best possible service; in order to comply with

the desire for a change often met with among merchants, Mr. Macbeth pointed out that it is a good policy to not only see that the merchant gets as much as possible for his money, but that it behooved the salesman to keep his customers alive to the ways and means available for making changes, as occasions require, as offered through the various means at his command. The speaker took up many other features of electrical progress, setting forth how essential it is to continually pursue methods which will please and keep up the interest of the consumer.

Many of the esthetic considerations of lighting were discussed at length at the joint meeting of the New York Chapter of the American Institute of Architects, and the New York section, May 2, Henry Hornbostel and Bassett Jones, Ir., presented a paper, entitled "The Relation of Light to Shade and Color in Design." This was supplemented by remarkable stereopticon views, together with models. color booths, etc. Harmony and design were the main topics of the evening, actual illustrations being offered to show what great differences are obtained according to the direction whence the light comes. The effects of light on different color screens, papers, etc., contributed to one of the most thorough studies of this character which have been presented.

At the meeting of the Philadelphia section, May 17, Professor A. J. Roland gave the fourth of his series of lectures, taking up the question of calculation of illumination, together with principles of photometry. His lectures were particularly interesting, being accompanied by practical illustrations and lantern slides. The attendance was 187, members and guests. The officers for the ensuing year were elected as follows: Chairman, Prof. A. J. Rowland; secretary, L. B. Eichengreen; managers, J. D. Israel, F. N. Norton, R. F. Pierce, George A. Hoadley, and E. B. Gillinder.

The annual convention of the society will be held at Niagara Falls, probably in September, the exact date not yet having been announced. Norman Macbeth is chairman of the Convention Committee.

CURRENT LITERATURE

New Books

AN ELECTRICAL METERMAN'S HAND-

The National Electric Light Association's Committee on Meters is preparing for publication at the Seattle convention the Electrical Meterman's Handbook.

This book will contain practically all authoritative information required by any one in charge of the operation of electric meters, from the standpoint of the executive, the installation, or the testing department, and for the guidance of civic commissions. It has been compiled to fulfill the urgent need for authoritative action toward the establishment and elucidation of standard modern electric meter practise, and the compilation of available data in one place for ready and convenient use of the testers and metermen of the thousands of companies whose technical abilities are more or less limited, as well as those of larger companies whose organization is more complete.

Every effort has been made to make the matter understandable by the non-technical man by eliminating cumbersome mathematical demonstrations and details; although full, simple, and satisfactory ex-

planations are always included.

The Electrical Metermen's Handbook is not intended to supplant the Meter Code, which is a more technical and scientific work, and which does not set itself the task of supplying details of operation and testing as is done by the Handbook. The latter is, therefore, supplementary to the former and completes the necessary bibliography on this subject.

The book will be issued to members at \$2 per copy, and to non-members at \$3, with discount on quantities. The book is about 900 pages, in flexible cloth cover, with 750 illustrations. The size of type

page is 6 by 4. Several hundred copies have already been ordered by larger central station companies for their meter departments.

American Items

Electrical World:

NEW SYSTEM OF BOARDWALK LIGHTING AT

ATLANTIC CITY; April 6.

TESTS ON GAS AND ELECTRIC ILLUMINATION IN AN AUTOMOBILE FACTORY, by H. H.

Magsdick; April 6.

ILLUMINATION OF BALTIMORE'S AUTOMOBILE SHOW; April 6.

ON THE ULTRA-VIOLET ENERGY IN ARTI-

FICIAL LIGHT-Sources, by Dr. Louis Bell; April 13.

SUCCESSFUL APPLICATION OF TUNGSTEN LAMPS IN RAILWAY WORK; April 20.

TUNGSTEN OUTLINING OF MINNEAPOLIS COMPANY'S BUILDING; April 27.

SERIES TUNGSTEN STREET LIGHTING WITH ARMOURED CABLE; April 27.

ELECTRIC FOUNTAIN IN NEW GARDEN; April 27. SHOW WINDOW LIGHTING, by R. J. David-

son; May 4.

NEW HEXAGONAL FIXTURES ON LAKE SHORE BUFFET CAR; Railway Electrical Engi-

neer, May. Simple Methods of Good Lighting, by W.

A. Durgin; Electric City, May. Brampton's Street-Lighting System; Elec-

trical News, May.

THE PRINCIPLES OF INDUSTRIAL LIGHTING, by Thomas W. Rolph; Industrial Engineering, May.

WHAT KANSAS CITY HAS DONE TOWARDS AN ORNAMENTAL STREET LIGHTING SYSTEM, by George H. Bowles; American City, May.

THE SIGNIFICANCE OF ORIGINALITY IN MOD-ERN GAS LIGHTING, Chapter VIII., by F.

L. Godinez; Progressive Age, May I. HIGH PRESSURE GAS LIGHTING, by B. G. Glover; American Gas Light Journal, April 22.

EDITORIALS

THE EFFECT OF ULTRA-VIOLET LIGHT ON THE Eye-Sight; Electrical World, April 13.
The Melting Points of Tungsten and Tantalum; Electrical World, April 20. DAYLIGHT; Electrical World, April 27.



IN THE PATH OF PROGRESS

The New Westinghouse Alternating Current Flame Carbon Arc Lamp

In the ordinary open and inclosed carbon arc lamps, light is produced by the intense heat developed at the tip of the positive electrode, which heats it to incandescence; the arc itself, being composed of pure carbon vapor, is non-luminous. By impregnating the carbons with certain salts, a flaming arc is produced that is, the salts, volatilized in the arc, make the arc itself luminous. By this means a much higher intensity of light is obtained for the same expenditure of energy. This resulting high efficiency and intense light has made the flaming arc lamp very desirable for certain kinds of illumination, but such lamps have had the serious drawback of requiring frequent trimming.

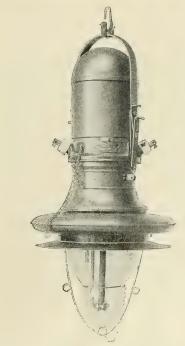
This drawback has been entirely overcome, and the distribution of light considerably improved in the long-burning flame-carbon arc lamps of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, which have a burning life of over 100 hours. The illumination is remarkably uniform, and there are no shadows under the lamps. All magnetic fields are perfectly compensated, so that the arc is very steady, and the difficulties of flickering noticed in earlier types of lamps of this character with vertical carbons is eliminated.

The flame carbon arc lamp will furnish greater average intensity of light on the working plane than any other type of lamp for the same maintenance cost, this by reason of its high efficiency of light production in the most useful direction and the long carbon life obtained with practically no decrease in candle-power up to the end of the trim.

To secure long burning life of the carbons, the arc is inclosed in a chamber to which the supply of air is limited, as in the case of the standard inclosed arc lamp. In the flame-carbon lamp, however, the efficiency is reduced very little by the inclosure.

Only one globe is used, of a peculiar design that enables it to perform the double function of inclosing globe and condensing chamber for the heavier fumes from the arc.

The lower part of the lamp shell constitutes a condensing chamber for the lighter fumes from the arc. In operation the lighter fumes rise up into this chamber and deposit on its cooler surfaces. By reason of the large surface it is not necessary to clean it out, except at very long intervals. This condensing chamber is separated from the mechanism chamber, and can be readily cleaned by the trimmer without removing any part but the globe.



THE NEW WESTINGHOUSE A. C. FLAME ARC

The lower part of the globe acts as a condensing chamber for the heavier fumes. As the upper portion of the globe is warm, it has no deposit and remains clean to the end of the trim. By this means a lamp having a life of approximately 100 hours, and comparing favorably in candle-power and efficiency with the short-burning type, has been obtained.

A large and rugged economizer is placed immediately above the arc, shielding the lower frame casting and the mechanism chamber from the heat. This economizer becomes coated with deposits from the arc vapors and presents a white reflecting surface, greatly increasing the light under the lamp. A fire-enameled reflector outside and immediately above the globe improves the light distribution and removes all shadows.

The mechanism is contained in two separate chambers. The lower of these in the series lamp contains the framework on the lamp, the upper carbon guides, and the starting resistors. Ample ventilation is provided by screened openings in the cast at each end of the lower mechanism chamber to remove the heat generated by the resistors.

The upper chamber in the multiple lamp contains the auto transformer and all the control mechanism of the lamp. The upper frame casting forms its base, and the cover is a solid cap which fits tightly around this casting, and is held in place by a bayonet joint. As the mechanism is remote from the arc and in a dustproof chamber, all troubles from heat, fumes, and dirt are avoided.

The auto transformer of the multiple lamp, which provides the proper voltage at the arc terminals, has taps so that the lamp can be accurately adjusted for any

voltage from 100 to 125.

The mechanism is of the focusing type, arranged to feed both carbons and maintain the arc at all times in the one position necessary to obtain the best distribution of light. To obtain the easy and steady feed of carbons essential in a lamp of this type, a ratchet feed is provided. Whenever the ratchet is released the carbons feed together by gravity. In burning, the winding pulls the carbons together to the limit of its movement; the ratchet is then

tripped, allowing gravity to bring the carbons slightly nearer together. The accompanying change in the strength of the magnets allows the rocker arm controlled by the coils to assume its normal position. This floating feed makes unnecessary any clutch mechanism with its attendant troubles and irregular feeding. A dashpot with self-lubricating graphite plunger precludes any tendency of the mechanism to "pump."

Each lamp undergoes a 2000-volt test

for one minute before shipment.

A uniformly impregnated carbon is used in this lamp. Carbons producing either yellow or white light may be used.

The lamp can readily be trimmed and cleaned by simply removing the globe.

The standard A. C. series lamp is adjusted for 10 amperes with 50 volts at the terminals, but may be operated on series circuits of lower current value by using a separate auto transformer with each lamp. This transformer is entirely weatherproof, and is arranged for mounting directly above the lamp. In case the secondary accidentally open-circuits, the auto transformer will operate continuously without injury to the windings. The lamp consumes 425 true watts. The electrical efficiency is 94 per cent.

The multiple lamp is adjusted for 10 amperes at the arc, $6\frac{1}{2}$ amperes at the terminals on 100 volts, and consumes 425 true watts, and the electrical efficiency is

83 per cent.

The Nelite Works of the General Electric Company

The Holophane Company and the Fostoria Glass Specialty Company have been consolidated into one organization to be known as the Nelite Works of General Electric Company, with headquarters in Cleveland, Ohio. The factories will remain in Fostoria and Newark. The Holophane Engineering Department will also remain in Newark for the present. The removal of sales and accounting departments and the change of name took place April 29, 1012.

This new organization will manufacture and sell the various different lines heretofore listed by both, including Holo-

phane prismatic glass, Veluria, Iris, Holophane-D'Olier steel reflectors, and numerous specialties.

The sales and engineering departments are directly in charge of Van Rensallear Lansingh, and the manufacturing department under E. O. Cross.

New Method of Enrollment, N. C. G. A.

A departure is about to be made in the membership of the National Commercial Gas Association. Following the resolution passed at the Denver convention, last October, provision has been made to en-

roll company members.

Since the N. C. G. A. was organized only individuals who were interested in the industry have been eligible to membership, and, while the enrollment of approximately 3000 at the present time is a satisfactory indication of the association's popularity and strength, it is felt that the time has arrived when gas companies themselves and the manufacturers of appliances should be given an opportunity of joining more actively in the work and advancement of the association and its influence for progress in the industry at large.

New Publications

"The New and Better Way" is the title of a booklet on indirect and semiindirect illumination recently sent out by Pettingell-Andrews Company, Boston. The booklet discusses these two phases of illumination at considerable length. Illustrations of various kinds of installations are presented, with descriptive articles some with fixtures of the simplest design, while others quite ornate.

Bulletin No. 720, of Pass & Seymour, Inc., Solvay, N. Y., details fully the number of P. & S. Ready Wired Porcelain Receptacles, Mica Sockets, Receptacles, etc. It also includes an illustration and description of the "Shurlok Locking Attachment" for preventing the theft of

Mazda or tungsten lamps.

Personals

Mr. Norman Macbeth has resigned as illuminating engineer for the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and the Westinghouse Lamp Company, Bloomfield, N. J., where he recently organized an illuminating engineering department, and will resume his individual consulting illuminating engineering practise. It will be recalled that previously Mr. Macbeth was identified as the organizer of the Illuminating Engineering Laboratories of the Welsbach Company, Gloucester, N. J., and illuminating engineer for that company.

Mr. Macbeth has had a singularly fortunate experience in the field of illuminating engineering during the past several years, and is generally recognized as having a thorough grasp of the subject from both purely technical, practical, and commercial standpoints. He will give special attention to illumination development and publicity for central stations and gas companies with particular reference to the education of salesmen, sales campaigns, and



NORMAN MACBETH.

the handling of competition policies. He will maintain offices in Philadelphia and

in New York City.

The readers of this publication will, doubtless, be pleased to know that Mr. Macbeth after making a trip extending across the continent, incidentally attending the National Electric Light Association Convention in Seattle, has arranged to contribute a series of articles to Good Lighting on some minor phases of modern illumination.

Mr. James R. Cravath, the well-known illuminating engineer, announces that he has moved his headquarters, with increased office facilities, from 1570 to 1160 Old Colony Building, Chicago. Mr. Cravath announces that he is in the field for illuminating engineering service, including the design of appliances, reflectors, etc., tests and measurements of illumination. Mr. Cravath is open to engagement for the management, operation and construction of electric light and power companies, especially those serving communities of less than 10,000 population.

The Benjamin Electric Mfg. Company, Chicago, has added to its sales force A. E. Lubeck, who will travel in the Central States, with headquarters in Chicago. They have also secured the services of Otis L. Johnson, formerly with the National Electric Lamp Association, who will have charge of the illuminating engineering department.

Mr. O. V. Maurer, formerly factory superintendent of the Cleveland Miniature Lamp Works of Cleveland, Ohio, has been appointed manager of the New York Miniature Lamp Works of General Electric Company.

H. H. Kunde, well known in electrical circles in the Pittsburgh District, and who for some time past has been connected with the Doubleday-Hill Company, has severed his connection with that company, to become manager of the Pittsburgh branch of the Peerless Lamp Works, Warren, Ohio. Mr. Kunde has established headquarters at 2014 Jenkins Arcade.

Mr. Chas. T. Jaeger, general sales and factory manager of the Jaeger Miniature Lamp Company, announces his active retirement from the firm he founded fifteen years ago, and built up to the present high standing. While Mr. Jaeger may continue to act in an advisory capacity, his future efforts will be principally devoted to research work and developing the industry from a manufacturing standpoint.

The Benjamin Electric Manufacturing Company, Chicago, has removed its New York office to larger and more convenient quarters at 114 Liberty Street. B. G. Kodjbanoff still continues as Eastern and Export Manager, with R. H. Ruth as his assistant.

Mr. H. K. Annin, until recently engaged in commercial engineering work with the Engineering Department of the National Electric Lamp Association, at Cleveland, has left this post to assume the managership of the Elux Miniature Lamp Works of General Electric Company in New York City. Mr. Annin has a wide acquaintance among the miniature lamp trade, particularly the buyers of automobile lamps, and this, coupled with his technical knowledge of the miniature lamp business, makes him particularly fitted to conduct successfully the duties of his new position.



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E. S. STRUNK, Managing Editor.

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Notes on Ornamental Tungsten Street Lighting

How "It Has Been Done" In Various Instances

By S. G. HIBBEN AND ALAN BRIGHT

President Lincoln, when asked his opinion of a certain book, once replied, "For the kind of people that like that sort of a book, it's just the kind of book for that sort of people." Were anyone to ask concerning the general advisability of ornamental street lighting, the answer

would have to be about as broad as that of Lincoln's, and to the effect that ornamental street lighting was advisable where the people want that kind of lighting. And the question of what is the usual practise of starting such a system, and of installing and operating it, would be met



FIG. I .- HAMILTON, OHIO.



FIG. 2 .- WARREN, OHIO.

by a broad answer also, for civic conditions, community needs and personal opinions all influence and govern these matters with varying results. Larger cities are more conservative and are not prone to changes that involve large areas and large capital; hence the majority of the ornamental lighting systems are in the smaller cities throughout the Middle West, where they are the original installations and have not necessitated the replacement of existing expensive arc lamp installations.

Two or three years ago, when the ornamental system was introduced, it was looked upon as an expensive luxury that would probably be used only for small installations put in privately by individuals or for the exterior lighting of public buildings. The idea that this form of lighting would be adopted generally to light the entire business sections of many cities, or that it was destined to be the only municipal way of "animating avenues that would die after sunset," was not appreciated at that time.

The notes on ornamental tungsten street lighting that compose this article are taken from a number of installations and are intended to show the ways "it has been done" in specific instances, which are neither unique nor especially typical, but are interesting as illustrations upon which to base the modified design of any ordinary system.

I.—WAYS AND MEANS.

(a) From Viewpoints of Owners, Merchants or Tenants.

Street lighting, from one point of view, is a commodity enjoyed by the merchants or tenants who benefit financially from it, and hence should be paid for by them. When people see the ornamental posts in front of a store, they are at once convinced that it has been the merchant's endeavor to make shopping a pleasure for them. This action marks the merchant in their minds as a progressive and up-to-date citizen having a push and a liberal amount

of civic pride for his and their district, in which both live and do business. Keeping this in mind, many merchants willingly pay so much per foot front, or pro rata. In dividing costs between owner and tenant, the most feasible way is an equal division, or else, as is the plan in Cedar Rapids, Iowa, to charge the cost of installation to the property owner, inas-

much as it is a permanent improvement, and charge maintenance to the tenant. Here the property owners have paid \$100 per post, while the tenants pay \$70 per post per year, or 10 cents per foot front, to cover operation, painting, lamp and globe renewals, inspection and control.

The cost per post in Billings, Mont., has been about \$80, and tenants divide the maintenance charge of \$60 according to frontage. Here the movement of the city council in turning down the proposition was not sufficient to discourage the citizens when they were assured of a good investment. The energetic property owners of Peoria, Ill., have installed posts at \$2 per foot front, while the merchants of Mendota, Ill., have on the average contributed \$12.50 each, to buy the posts only. The costs to the merchants in this case would doubtless have been higher had not the central station wired, set and equipped these posts. The cost to merchants and owners in 19 cities of Iowa averages \$71, though going as high as \$125.

Another instance in Hamilton, Ohio, shows tenants paying \$12 per foot front per year, while the owners, as incited through the wideawake "Commercial Club," have paid \$80 per post for

the complete installation (Fig. 1.). A similar club of merchants in Pana, Ill., have seen an advertising value to individuals justifying an expenditure of \$50 per post and seizing the opportunity to induce the council to remove all unsightly posts and wires from main streets to alleys.

In Atlanta, it might be noted that a total maintenance charge of \$1.92 per foot

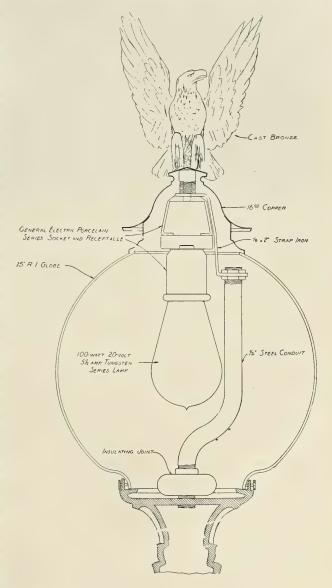


FIG. 3.—METHOD OF TUNGSTEN LAMP SUSPENSION USED IN WASHINGTON, D. C.



FIG. 4.—SIXTEENTH STREET, WASHINGTON, D. C.

front is divided equally between owner and tenant, while in Racine, Wis., the total cost becomes a tax against the property—again as a permanent improvement—and is put on the tax books and collected from the tenant by the owner.

Another "Commercial Club" in Duluth, Minn., started the movement for ornamental tungsten street lighting in 1909, and the property owners felt justified in paying the expenses pro rata. These expenses were \$1.50 per foot front for installing and \$55 per post per year, or 69 cents per foot front, for maintaining. Lessees pay this latter charge, or the property owners if the property be vacant. A three-year contract is taken up by the merchants of Anniston, Ala., with the central station, whereby owners assume part of a cost of \$1.65 per foot front per year, this to cover expense of installation and maintenance, with current at 7 cents per kilowatt-hour.

Still another noteworthy arrangement is that at Hamilton, Ont., where owners pay 12½ cents per foot per month. One of the largest recent installations, that of Columbus, Ohio, has been a growth from

a beginning that was made by the property owners when, years ago, the decorative festoon arches were placed over High Street and are now being replaced by 900 five-light standards at a cost of \$100,000.

Property owners in Omaha, Neb., have installed decorative post lighting, as they have in Niagara Falls, N. Y.; Berkeley,

Cal., and San Diego, Cal.

In general it is unwise to fix a cost per post when tenants are paying the expense, since the length of blocks and the number of posts per block vary, and dissatisfaction is liable to arise. A better way is to charge per foot front. It is also unwise to get individual signatures for maintenance (this does not apply to erection), since merchants move, quit business, etc. These considerations suggest making a general contract with the city as far as possible.

The above instances and many others indicate the views taken of ornamental street lighting by property owners and tenants. That these people have started the movements and have assumed the expenses is indicative of their firm belief in returns from the investment and shows

that there are profits to at least this one class of citizens.

(b) From the Viewpoint of the City.

Not only are part of the expenses of an ornamental system chargeable to advertising the sales houses, but also part is chargeable to city illumination and decoration. The city, from this point of view, should be instrumental in starting the project and should bear part of the costs. As to just what part of the expense the city should bear has been a bone of contention leading to much dispute, and with little avail, for it is seemingly impossible to measure in dollars and cents the benefits to the city resulting from improved methods of lighting and decorating its group of business thoroughfares. Along boulevards and parks there is no question but that the lighting installations should be put in by the city alone. The public enjoys it, and the people owning property facing on such thoroughfares benefit only in so far as the improved general appearances tend to increase renting or property values. The city should, in fact, do more than improve its parks if it is to keep abreast of the other cities, for if it is true of any civic department at all, it is certainly true in the department of public lighting of business streets that there is no escaping the odium of unfavorable comparisons. Let the city appear prosperous and it will be the first step toward being so.

The city of Atlanta has taken this point of view, and contracts for \$45 per post per year to maintain their very creditable ornamental tungsten system. Such payments are for current and for lamps, globes, control, painting twice yearly and washing twice a month. In Poughkeepsie, N. Y., the city pays for both installation and service, and in Mendota, Ill., the city pays for all maintenance in the central business district, at a rate of \$4 per post per month. A novel installation of stone posts has cost the city of Bloomington, Ind., \$35 each, while \$1 per post per month covers the maintenance, also borne by the city.

Rochelle, Ill., through its municipal electric plant, operates its street lighting as a civic necessity. The city of Omaha,

Neb., appealed through its "Commercial Club" to the Nebraska Legislature for an amendment to its charter allowing that city to raise and maintain a uniformly high standard of ornamental street light-Here the city would pay maintenance charges, similar to the way such charges are borne in Pana, Ill., and Duluth, Minn. Recently the merchants on Federal Street, Pittsburgh, having decided that an ornamental street lighting system would improve business on their thoroughfare, took their proposition before the city council without making any attempt to secure the financial co-operation of property owners. The emphasis was placed upon the fact that the increase in property values would net the city in increased taxes an amount equal to the expense of the installation. The Pittsburgh Council, after careful deliberation, appropriated \$10,000 to cover all ex-

(c) From the Viewpoint of the Central Station.

Having noted instances of the operation of ornamental tungsten street lighting as being carried on by the merchants and by the cities, the relation of this movement to a third party—the central station—may be touched upon.

Too often there is but little assistance in this direction, yet here would be the last place one would expect lethargy. One can often see a reason for this hesitancy on the central station's part, however, when keeping in mind the following facts:

When the electric light companies suggest changes or go on record as favoring some new thing, the consumers of electric power immediately become suspicious, their imaginations seeming to tell them that all such movements are schemes on the part of the electric light companies to increase their revenue. As the central stations do not like to be regarded in this light, they would much prefer that others take the initiative and introduce these new ideas.

Consequently it may not be feasible to leave all initiative or place all blame with the lighting companies for the movement or the lack of it. Regardless of how the movement is begun, it is thought that with the central stations should rest the final decision as to the size and number of lighting units, the arrangement of lamps and the methods of installation.

Why should the central station get behind this decorative street lighting? Because these lighting systems create visible impressions on the citizens and induce favorable comment toward the lighting company. It shows that those whose business it is to produce light are not enemies of the people, but friends, and if the central stations obtain more friends or boom the population, then the population booms the central station. New citizens, or unpatriotic ones, may trade elsewhere, in food or wearing apparel, but they all must buy their light at home. It has been proven that the most trouble coming to the public service companies is because the public takes them by default. Public sentiment may run calmly along for years, but secretly gathering dissatisfaction, then suddenly overflow its banks to municipal ownership or the like. The wise central station rides on the flood tide and not among the debris.

In Mendota, Ill., the central station seized the opportunity of uniting with the ones interested in a new ornamental installation and placed all its service wires underground, together with the lamp-post wires. The electric company of Hamilton, Ont., started the street lighting movement, and pushed it by making minimum charges for lamps and globes, as well as supplying free current to parks. electric light company of Faribault, Minn., has borne the initial expense of 106 standards recently installed. In 1910 the central station of Poughkeepsie incited this kind of lighting, as has been the case in Milwaukee, Chicago and elsewhere.

As a novel procedure of animating the public, the lighting company of Billings, Mont., resorted to a popular discussion of decorative public lighting in the supplement of the Sunday papers. No editions were more popular.

The conditions in the West cannot be compared with those in the East, except as such comparisons result in friendly comment. In this spirit a close observer notes that in many of the Western towns there is one post for every 400 citizens, which means 120,000 posts if in the same pro-

portion in New York City. Surely there are opportunities in the East for central stations to foster and develop decorative street lighting as a pure policy of good finances.

II.—Some Methods of Installations.

(a) As Concerns Posts, Wiring and Spacing.

Among the various ornamental tungsten boulevard installations, the three items of posts, current supply and arrangement of posts are among the most uniform—and naturally so, since (1) moderate heights and permanent materials of posts (2) supply mains well protected, and (3) spacing for a predetermined minimum illumination are the three simple requisites that have not as yet called forth any wide variations in making up the plans. When first introduced it was the high costs of heavy cast iron posts and expense of elaborate wiring in underground conduits that worked against these systems. Modern posts are of lighter construction, and modern wiring is done by inexpensive lead and jute covered cable reinforced with steel tape that makes the cable electrically and mechanically secure.

When Warren, Ohio, the first Eastern city lighted by tungsten lamps, began in 1908 to install street lights, use was made of flat hoods on goose-neck arms for the supports. Now this city employs the typical five and three-light standards (Fig. 2) of cast iron and rolled steel, served underground, and spaced 65 to 80 ft. On each corner are eight posts, arranged at the points of intersections of the property lines with the curbs.

In Cedar Rapids, Iowa, the five-light 340-watt standards are staggered 68 ft. apart, in order to place a post on the alleys. The staggered arrangement was condemned by the South Park Improvement Association of Chicago on account of too great a contrast in the light and dark places of the pavement. They used 250-watt lamps, all on one side of the street and spaced 125 ft. In Billings, Mont., a beginning was made in 1909 with 50 320-watt cast iron posts spaced 95 ft., while Oklahoma City used standards of three lights, built of concrete, and spaced more closely together. In Hamil-

ton, Ohio, the corinthian iron posts, 10 ft. high, support five lights, or 300 watts per post, and Hamilton, Ont., has 525 watts per post, spaced 45 ft. Peoria, Ill., began with an installation on five blocks, six 340-watt posts to each curb of each block, spaced 72 ft. apart, making eight posts at each street intersection, while Mishawaka, Ind., has a 50-ft. spacing of three-light posts and one five-light post at each corner. In Mendota, Ill., the illumination is satisfactory with an 80-ft. spacing of 180-watt posts.

Throughout the New York parks the watts per foot of street is much less than in these cases above. The 60-watt lamps suffice. Adaptation is made of boulevard gas cast iron standards, equipped with white diffusing glass globes along the mall in Central Park and along the streets, and with clear glass globes are now being replaced [The clear globes are now being replaced]

by diffusing glassware.)

A novelty in cast iron post design is

found in Pueblo, Mexico, since in this city are found five-light posts in a strange griffin design that are pleasantly unique. Another modification in post design can be seen illustrated in Fig. 3. These are posts in the National Capitol that are capped with a bronze eagle, as shown. Another illustration, Fig. 4, shows a typical installation as on Sixteenth Street and Scott Circle of 10-ft. posts with 100-watt lamps spaced 60 ft. apart, measuring along the street, and staggered on a street 160 ft. wide. Here as in several other cases, care was required to place the lamps beneath the foliage of the trees. Posts are placed 45 ft. apart in Anniston, Ala., giving about 18 watts per running foot of street, while the 66-ft. streets of Duluth, Minn., are lighted by II watts per foot. Poughkeepsie has over 11/2 miles of 90-ft. posts, giving 8.8 watts per foot, and many more instances of similar character could be cited, but all of about the same details.

Notable among installations using posts



FIG. 5 .- LINCOLN PARK DRIVE, CHICAGO.

that are out of the ordinary are those in Chicago, on Lincoln Park Boulevard; Riverside, Cal.: Cherokee and Oklahoma City, Okla.; Bloomington, Ill., and Toronto, Ont. Along Lincoln Park Boulevard are single concrete shafts (Fig. 5) 14 ft. high, with 71/2-ampere series arc lamps in Alba 20-in. globes. It is remarkable that of the 215 globes in use the first year, there was absolutely no break-The unique design of reinforced concrete posts that are so harmonious in Riverside, Cal., can be seen illustrated in Fig. 6. These posts bear 260 watts of illuminant and are spaced 100 ft. apart. Cherokee's single light posts are of concrete, and in Oklahoma City the same material is used, that has been cast in twopart moulds, with reinforcement,* at a cost for casting of \$4, and when capped with hammered and soldered copper sheet cost \$18.

In Bloomington there are over 120 posts that are cut from the native limestone and were installed in 1910. They are cheap and handsome; they advertise the city's chief industry, and are permanent through being impervious to frost-cracking. In Atlanta a wire provision for decorative festoon lighting has been made by placing outlets beneath the outer arms of the posts.

Finishes of iron posts are mostly in dark green paint, but as exceptions one may note a white enamel finish applied in Vancouver, B. C., and aluminum painted (gas) posts in Pueblo, Colo. On the green trolley posts of Poughkeepsie are found aluminum painted collars and armtips that appear well when freshly painted.

New York's Central Park has the typical underground service, where metal armored cable is merely laid in a shallow trench and covered with sod. A similar system is in use in Bloomington, feeding into the stone posts, but here the cable has been laid in a continuous run and is looped into the bases of the poles to avoid underground splicing. This latter method proves fairly inexpensive, averaging 20½ cents per foot. Duluth, Minn., was put to the unfortunate expedient of chipping



FIG. 6.—RIVERSIDE, CAL.

a trench in the sidewalks inside of the curb and patching above the conduit with cement. Poughkeepsie has laid four-arm tile duct beneath the street surface for over 1 1/4 miles at a cost per foot of 0.6 cent.

It is not unusual to see the feed wires laid in fiber ducts imbedded in concrete laid under the curb or in a trench cut in the asphalt just along the outer edge of the curb. Such is the system in Peoria, Ill., and along Riverside Drive.

If due modifications are always made for specific cases, the following summarized table may be used for cost estimates of post and wiring:

For one 5-light ornamental iron standa	rd:
First cost of post	\$35.00
Lamps and sockets	5.60
Glass globes	
Erecting, wiring (post) and concrete base	8.00
Supply cable (65 ft. lead, jute and steel	
at 25c.)	16.25
Laying cable at 60c. per foot	39.00

Total cost per post.....\$107.85

Costs of transportation and elaborateness of design will influence the cost of

^{*} Reinforcement should be put in under tension, since shrinkage of concrete places the iron rocs in compression.

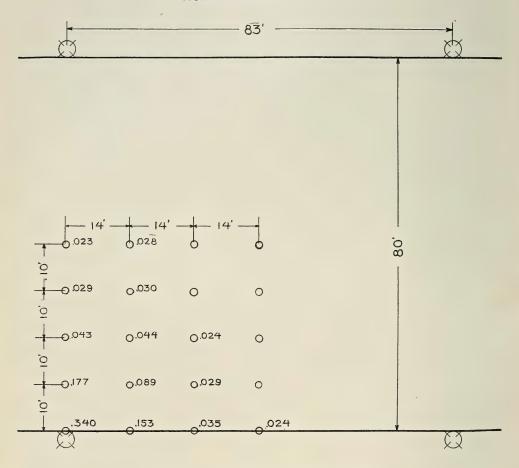


FIG. 7.—DAYTON, OHIO.



FIG. 8.—MICHIGAN AVENUE, CHICAGO.

ILLUMINATION CHART INDIANAPOLIS IND. WASHINGTON ST.



CRYSTAL ROUGHED INSIDE BALLS

FIG. 9. 5-100W TUNGSTEN

posts. Labor charges will change the fourth and also the last items. The cost of laying cable will be much less if the work does not involve chipping a trench in the cement, which has been the case considered in making the above estimate.

(b) As Concerns Lamps and Globes.

With a certain post spacing the size of lamps will be determined by the number per post and by the wattage per post to give a minimum value of illumination. But also there must be due consideration given to an illumination that will not interfere with show window displays. No serious conflicts will arise, however, if one considers that it is the intention of ornamental street lighting to attract pedestrians to the locality of the window displays, and whatever slight loss the windows suffer from less contrast with the exterior is more than compensated for by the added quantity of attention they receive.

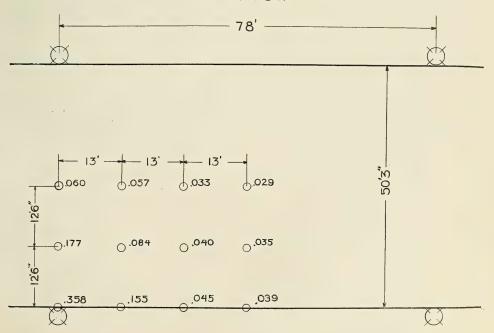
Notes on various installations show the usual combinations of lamps to be 60 and 40 watt, or 60 and 100 watt tungstens. Truly, it would tax one's patience to enumerate the varieties of combinations— Billings, Mont., with one 60 and four 40 watt lamps; Rochelle and Mendota, Ill., with three 60's; Peoria and Cedar Rapids, with one 100 and four 60's; Anniston, Ala., with five 80's; Duluth, with five 100's; Hamilton, Ohio, with five 60's, etc. The yearly costs involved in lamps and globes for Poughkeepsie's four 100-watt posts are fairly typical, amounting to \$10 per pole for lamps and \$1.90 for labor of renewing. Globe renewals and incidentals that include painting amount to \$3. An average of some 50 five-light post installations shows the total yearly operating cost to be about \$50.

As to the matter of whether the lamps

on a standard should be arranged all in an upright position or in a pendant position, there is much to be said for both methods. Upright globes may be more easily removed for cleaning and they avoid the tendency of gathering dirt inside, but, on the other hand, there is the possibility of the formation of ice in the fitter, causing breakage or preventing removal, or leakage of water into the posts, as well as slightly less illuminating efficiency compared to pendant globes.

From the standpoint of illumination the pendant arrangement seems to have a slight advantage. Out to a distance of 50 ft. from the lighting standard this has in one case been found to be an increase of 35 per cent. in illumination, as compared with the upright arrangement.* Fig. 7

DAYTON CHART DAYTON O. FOURTH ST.



ALBA BALL GLOBES

1-100w - 4-60w TUNGSTEN

^{*} Discussion of paper on "Gas, Gasoline, Arc and Incandescent Electric Street Lighting," read

shows the upright arrangement as in Dayton, Ohio, Fig. 8 shows pendant globes

on Michigan Avenue, Chicago.

There are a few clear glass globes used in the ornamental lighting systems and a few reflectors, but nine tenths of these installations have the white glass diffusing ball globes, two thirds being of the kind of glass known as Alba. Sizes of globes are usually 10, 12 and 14 in. in diameter, with the limits set on the one side by allowing room for the lamp and having not too high intrinsic brilliancy, and on the other side by weight, breakage (from winds) and proportions suitable to the shaft of the post.

III.—Points of Control and Per-. FORMANCE.

The use of a large number of ornamental standards has led many cities to adopt the practise of cutting out a portion of the light at midnight and allowing the remainder to burn till dawn. This practise has been often criticized, some persons believing it to be an example of false economy and altogether inconsistent with modern progressive methods. However, it must be remembered that the object in securing a comparatively high degree of illumination on business thoroughfares is to attract people and stimulate trade. During the hours from midnight till morning little or no business is carried on and comparatively few people make use of the streets. In other words, the functions of the lights at this time is to merely provide an illumination of such a degree as to insure safe travel and protection to property owners. Many cities arrange the lights on two or more circuits so that at the close of business hours a portion of the lights may be turned off. Thus in Columbus. Ohio, the four pendant lamps on each standard are turned off at midnight. the one upright lamp burning till morning.

The majority of the work of turning on and off the lamps of the ornamental tungsten systems is done by patrol, from manually operated switches in the base of the posts, which switches control several posts—usually those along that side of the

block. In Poughkeepsie this form of patrol before the Pittsburgh Section of the Illuminating Engineering Society, April 12, 1912, by H. H.

Magdsick.

prevails, and again in Atlanta is found this same method, with switches in the corner posts. Duluth uses the central post (of five per side of each block), where there are two switches that operate the single upright lamps and the four pendant

lamps of that block.

There is an objection to manual control, embodied in the time and expense (it costs in Davenport, Iowa, 50 cents per post per month) and the unsightly appearance of sections along a street being lighted rather than all the lights flashing on simultaneously. Alternatives to hand switches are found in Peoria, Ill., and Anniston, Ala. In the latter city they use clock switches and in the former the switches are operated by solenoids. rent is always in the control circuit; amperes holds all the switches in till midnight, when the current, in falling to 4 amperes, drops out the switches far enough to cut out the 60-watt pendant lamps, but leaves the contact on the upper lamps.

Series circuits are naturally operated from one distant point. In Lawrenceville, Ill., it is found expedient to maintain a filament heating current in the series tungstens, of which there are 78 100-watt and six 6-ampere. In a windstorm six lamps were once broken and the combined resistance of the resistance-film cutouts was too great to be broken down, so that service was interrupted till broken lamps

could be found.

In the photometric performance of the ornamental systems one may note the following cases for details of typical cases.

A summary is made in the following table:

> Day- Indian- Toton, apolis, ronto, falo,

Ohio. Ind. Ont. N.Y.
Watts per linear foot. 8.71 12.8 9.85 5.68
Watts per square foot. 0.173 0.211 0.235 0.095

The maximum and minimum of illumination, and its distribution, can be seen from the two charts, Figs. 9 and 10.

All that has been said above is far from being a totally comprehensive survey of the subject. These are random notes that afford information to the prospective user of these ornamental systems and bring out the everyday kind of working facts that appear from a study of these specific cases.

Modernizing the Lighting of a Church

How a Cleveland Church Improved Its Lighting Equipment

Some churches have found it expedient to revise their creeds within the past twenty-five years, while others have been satisfied to revise their physical sources of light. Compared with the centuries which were required for the construction of medieval churches, all of our own edifices are mere mushrooms in age; and yet the older of our churches are almost as antiquated in point of artificial illumination as their prototypes of remote times. The gas flame, which is still to be found in numerous cases, is scarcely an improvement upon the lamps and candles of antiquity, except in point of convenience.

The church building described in this



FIG. I .- THE CHURCH, SHOWING THE OLD EQUIPMENT, CONSISTING OF FLAT FLAME GAS BURNERS.



FIG. 2.—THE EFFECT OF THE NEW ILLUMINATION.

article may be classed among the older structures, as age goes in this country, and also among the better examples of Gothic architecture. As a building it is to-day not only a creditable structure architecturally, but both adequate and satisfactory for the needs of the congregation. The only fault found with the building was one incident to the progress of lighting during the past quarter of a century.

The interior is finished with the roof structure showing, and of a wood that has now become dark yellow with time, with trimming of black walnut; and the side walls are of a harmonizing and proportionally dark hue. The pews are of unstained oak.

A view of the nave looking toward the pulpit previous to the remodeling of the lighting installation is shown in Fig. 1. The lighting fixtures were designed for gas, and were elaborate, and, all things considered, very creditable pieces of work for their times. They consisted of globes

of repoussé brass, having small projecting arms thickly radiating from the equator. Just above these are four-arm fixtures of smaller size. There were three of these fixtures in the nave, one provided with 80 gas jets and the other two with 60 each. They were suspended 17½ ft. above the floor. In addition to this there were 28 wall brackets, equipped with two, three or six jets.

The problem consisted in lighting this interior electrically without any unnecessary wiring and without introducing any anachronisms in the way of fixtures, or results in illumination that would be uncomfortable to the audience or inappropriate for the place.

The expedient was happily conceived of utilizing the old fixtures by dividing them at the equator and using the hemispheres for the tops of spheres, the lower hemisphere being made up of a light amber art glass, leaded.

The appearance of the church with the

new equipment is shown in Fig. 2, and a close view of one of the remodeled fixtures in Fig. 3. In order to place these new spheres as desired one additional one was constructed. They were then suspended as shown by the plan, Fig. 4. In each of these spheres were placed five Mazda lamps, one 250-watt and four 150-watt, except in three fixtures, in which there were four 100-watt.

As it was figured that these spheres might not give sufficient illumination in the aisles, and as it was desired to avoid the use of side brackets, if possible, it was decided to place a leaded glass capital about the pillars which would serve as additional light-sources for this purpose. In order to avoid cutting out the apparent point of support of this luminous capital the leading at the angles was kept purposely heavy, so as to supply the apparent strength. A detail of this is shown in Fig. 5.

The general results of this change have proven satisfactory. The appearance of the fixtures, which had become associated with the church, has not been sufficiently changed to impair the sentiment of association; at the same time they are pleas-



FIG. 3.—A CLOSER VIEW OF THE REMODELED FIXTURES.

ing in themselves, and in general harmony with their surroundings. The illumination is practically uniform and sufficient to enable any one with ordinarily good

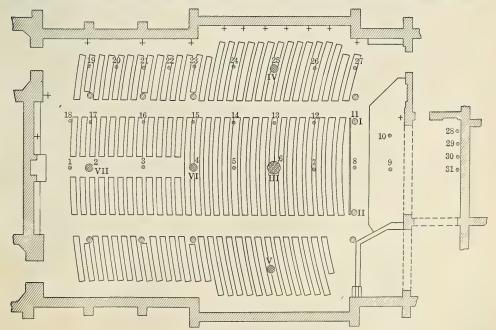


FIG. 4.-PLAN OF TEST STATIONS.

vision to read fine print without trouble.

To those interested in the engineering side of the problem the following results of tests will give an accurate record of what was accomplished.

PREVIOUS INSTALLATION.

The installation before remodeling consisted of 300 open flame gas burners and 56 16-c.-p. carbon lamps around the back of the arch in the chancel. The gas consumption as measured by the meter was 940 cu. ft. per hour, and the electric current, while the lamps were lighted, 3000 watts.

The installation after remodeling consisted of 12 100-watt lamps, 20 150-watt, 6 250-watt and 48 40-watt. The total consumption of current is 7620 watts. Illuminometer measurements were made with a Sharp-Millar photometer on a plane 3½ ft. above the floor at stations indicated on the plane. The results of these readings in both installations were as follows:

Table I.					
Station Readin	ngs.	Station Readin	igs.		
Gas.	Elec.	Gas.	Elec.		
10.336	0.87	160.172	0.66		
20.473	1.30	170.207	0.61		
30.328	0.84	180.205	0.53		
40.531	1.45	190.112	0.30		
50.402	1.27	200.134	0.32		
60.310	1.34	210.156	0.34		
70.161	1.22	220.140	0.30		
80.104	1.23	230.129	0.60		
110.081	1.09	240.131	0.91		
120.111	1.06	250.107	1.08		
130.171	1.22	260.103	0.78		
140.210	0.87	270.120	0.40		
150.242	0.82				
	ntensity-	-0.2 ft. C. Gas.			
		0.81 ft C Floo			

In addition to the above readings were taken in a horizontal plane at Station 8 at the level of the platform. The intensity at this point was 0.244 foot-candles

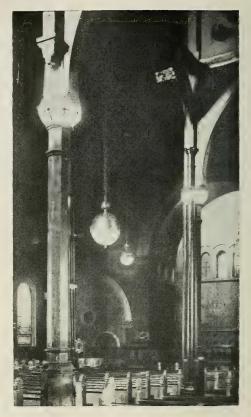


FIG. 5.—SHOWING EFFECT OF ILLUMINATION
FROM LEADED GLASS CAPITALS PLACED
ABOUT THE SUPPORTING COLUMNS.

with the gas installation and 0.94 footcandles with the electric lamp.

A series of readings taken in a vertical plane at the desk showed an average of 0.113 foot-candles with gas and 0.88 foot-candles with electric.

An Elaborate Electric Sign for Temporary Display

How the Allegheny County Light Company Welcomed the Knights Templars at Their Recent Conclave

By Drew Johnston.

Specially appreciated, naturally, by the Knights Templars, and of unusual interest to everybody, was the electrical emblem on display during the Pennsylvania conclave recently held at Pittsburgh.

The emblem was erected after months of designing and special arrangements by the Allegheny County Light Company of Pittsburgh.

This emblem, combined with other fan-

ciful illumination displayed on this occasion, produced a most elaborate and beautiful effect. Some idea of the efforts put forth to properly celebrate this occasion by use of electrical illumination may be had from the fact that its cost amounted to more than \$50,000.

Any one who was fortunate enough to have seen the illuminated emblem must necessarily be somewhat disappointed at the production appearing herewith, excellent as it is, because a special study was accomplished in color effects which are beyond present-day reproductions.

The sign represented a complete Knight Templar charm. Its dimensions were 24 by 24 feet, and contained altogether some 1700 16 candle-power incandescent lamps. All the lamps were in colors of natural glass. The sunburst was set in back of the cross and crown, and with flasher adjustments illumination was begun from the center of the sunburst. Then by degrees the lighting jumped from the center to gradually creep outward toward the sides, corners, and ends.

The cross was carried out in ruby lamps, and the crown was formed by opal,



FIG. 1.—THE ALLECHENY COUNTY LIGHT COMPANY BUILDING, SHOWING ELABORATE ELECTRIC SIGN USED DURING RECENT KNIGHTS TEMPLARS CONCLAVE.

green, blue, and amber lamps to represent the various jewels. The swords were formed by opal lamps in the handle to represent ivory, with frosted lamps in the blade. The letters, "IN HOC SIGNO VINCES," were in ruby lamps and also in the border of the cross. It was erected on the Allegheny County Light Company's main office, Sixth Avenue.

To supplement the Knight Templar charm electrical decorations were erected on the adjoining building—the emblem of the Department of Public Safety of the City of Pittsburgh. Both city and county buildings were also illuminated during

the period of the convention, which lasted from May 22 to May 29, inclusive.

Throughout the main thoroughfares of Pittsburgh there were examples of illumination, which were of the highest order; so that it certainly must have not only given a hearty welcome to the visiting Knights, but to all other visitors within the city's gates during that period. This served as an opportunity of showing the people of Pittsburgh themselves what facilities are presented for such electrical demonstrations, not only for the commercial advantages of individuals, but to the enhancement of the city as a whole.

Practical Notes on Illumination Design

(Concluded.)

By C. E. CLEWELL.

ILLUMINATION FACTORS.

Spacing.—As previously stated, the spacing distance may be determined to advantage as a distinct item preliminary to the selection of the size of lamp to be used. To this end values as indicated in Table I. are useful.

Type of Lamp.—From the standpoint of the salesman there is practically but one item connected with the choice of

LAMP

I = C. P. × COS³A

H²

X = DISTANCE FROM POINT DIRECTLY
BELOW LAMP TO POINT P

R = HEIGHT OF REFERENCE PLANE

H

C. P.

REFERENCE PLANE

P

X

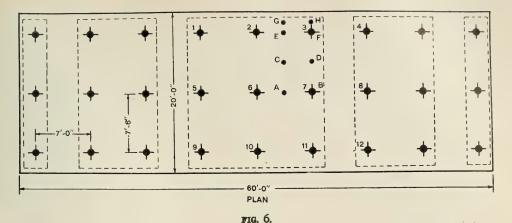
FIG. 5.

lamp, namely, the sale. From the standpoint of the illuminating engineer, however, this choice is dependent upon a number of items, mainly surrounding conditions, circuits available and the candlepower values of the various types under consideration.

The circuits available have a bearing on the case in that some types of lamps are best adapted to alternating current operation, others to direct current; some to series and others to multiple circuits.

The conditions of the space between floor and ceiling, that is to say, the presence or absence of belting or much dust or dirt held in suspension in the air, is a factor which should be given due consideration when choosing a type of lamp. It has been found by experience, for example, that certain lamps are less affected than others by the dirt connected with proximity to belting, and, likewise, that some lamps seem best adapted to those conditions where a large amount of dust, dirt or steam is in the air.

Size of Lamp.—As a general rule, lamps of small size should be used for low-ceiling height locations, and the size increased with higher ceilings. The relation between mount-



ing height and size of lamp is a matter which must be governed largely by experiment and experience. Table III., however, shows, in a general way, some of the sizes of lamps which are being used for various ceiling heights, and a reference to tables of this kind is most important when dealing with the whole question of lamp sizes.

A PRACTICAL PROBLEM.

The following items connected with the solution of a practical problem are given in sequential order for the purpose of making plain the steps which are considered advantageous in such work.

Condition.—A long, narrow office with a ceiling height of 11 feet is assumed. The dimensions of the office are 20 x 60 feet; the ceiling is of wood and of a light color; the walls are tinted a light green; general office work is performed, with a fairly crowded condition of desks, the surfaces of which are covered in general with light papers, and a 110-volt, 60-cycle alternating current circuit is available.

It is required, in this particular problem, to decide on the spacing distance, type and size of lamp, and mounting height for furnishing an illumination intensity of about 3 foot-candles on a working surface 2 feet 6 inches above the floor; and to determine the control arrangement which is sufficiently flexible in the matter of lighting requirements near and away from windows.

Spacing Distance.—A reference to Table II. indicates that for a ceiling height of

11 feet a spacing distance of from 5 foot 9 inches to 7 feet 3 inches has been used to advantage. From the standpoint of symmetry, a spacing distance of 7 by 7 feet 6 inches is chosen, which, from the table, may be assumed to furnish suitable directional features of the light.

Type of Lamp.—A reference to Table III. indicates that the ceiling heights of 11 and 12 feet, lamps of about 48 candle-power are used on the average. This, together with the supply circuit available, naturally suggests the use of 60-watt tungsten lamps.

Size of Lamp.—As just intimated, by a reference to Table II., lamps of 48 candle-power are the best size to use under these conditions, and whereas this value might be obtained by the use of three ordinary incandescent lamps in a cluster, it is rather advisable to use one single unit of the tungsten type, both for economy as far as energy consumption is concerned and from the standpoint of simplicity in installation.

Determination of Intensity.—Thus far no indication has been made as to the results which will be obtained by the given spacing and size of lamp as regards intensity. It is interesting to note, however, that provided the data is reliable, and such tables are available, the entire determination of lamps and spacing distances may be based on the method as just outlined. It is advisable, however, to check the arrangement of lamps as thus determined. For this reason the following simple check methods are set forth:

Utilization Efficiency.—By the term "utilization efficiency" is meant the ratio of the net light flux reaching the working surface to the total light flux developed by all the lamps in the system. Thus, if of a total of 5000 lumens developed by ten 60-watt tungsten lamps, 1000 lumens are effective on the work, which implies that 4000 of the lumens developed by the lamps are wasted in directions not useful to the work and are absorbed by dark surroundings, the system is then said to have an efficiency of 1000 divided by 5000, or 20 per cent.

It is obviously a simple calculation to determine the "utilization efficiency" of various lighting systems upon which accurate illumination tests have been made. If, for example, the average intensity over the working surface in a room of 400 square feet floor area is equal to 21/2 footcandles, the product of the floor space and the intensity, namely, 1000, is equal to the net light flux on the work. If, furthermore, the illumination is provided by nine 60-watt tungsten lamps, which, according to standard ratings, develop 4500 lumens, the "utilization efficiency" of this system is equal to 1000 divided by 4500, or 22.2 per cent. Table I. indicates a series of "utilization efficiency" values from which the constant to be applied to any given location may be found, that is to say, provided conditions of the given location are comparable to any one of the conditions given in such a table.

Having, therefore, determined the spacing distance and size of lamp according to tables, as previously described, it is a simple matter to check the intensity which may be expected by means of this so-called "utilization efficiency" constant. This is done by multiplying the total lumens developed by all the lamps in the system by the constant corresponding to the given conditions, and subsequently dividing this net lumen value by the floor area to ascertain the average foot-candle intensity which may be expected.

Point Integration.—As a further check on a design which has been based on experimental data, the intensities at various points on the working surface may be determined by adding together the intensities at any one point produced by all the lamps which contribute to that point. Fig. 5 indicates a simple working diagram which may be used for this purpose. By a reference to this figure, it is seen that the intensity at any given point produced by a lamp at a certain fixed distance from the point is equal to the candle-power produced by the lamp in the direction of the point, divided by the square of the mounting height and multiplied by the cube of the cosine of the angle between the direction of light and the vertical line passing through the lamp.

If, for example, the intensity at the point "A" in Fig. 6 produced by the lamp (1) is found, by means of this formula, to be of a certain value, the intensity at the point "A" due to the lamps (2), (3), (4), (5), (6), (7), (8), (9),(10), (11) and (12), may in like manner be found, while the addition of these several values gives the total intensity at the point "A" produced by the six lamps, irrespective, however, of reflection from walls and ceilings. This calculation obviously depends on the distribution curve of the lamps with the reflectors used, and can only be employed where a distribution curve is available, or where the value of the light in various directions around the lamps is available in tabulated form.

By a method of this kind the intensities at a sufficient number of points on the floor space may be found, and the average intensity, which is apt to result from the given arrangement and size of lamps, determined.

The Actual Checking of the Foregoing Problem.—A reference to Fig. 6, which has been drawn up to conform with the spacing conditions decided on from Table II., shows that a total of twenty-seven lamps has been selected for the typical problem involved. The total light flux developed by twenty-seven 60-watt lamps is 13,500 lumens. A reference to Table I. indicates that for light ceilings and fairly light walls under the conditions in question, the average efficiency throughout the performance of the lighting system is apt to be about 27 per cent. Hence, 3,650 lumens under this assumption will be effective on a working surface of 1,200 square feet, with a resulting intensity of 3.04 foot-candles. From a reference to

Table IV., this will be found to conform closely to average values of office illumination intensities.

Table III .- Typical Sizes of Lamps for Various Ceiling Heights as Used in Actual Installations.

Class of work.	Ceiling height. Ft.	Size of lamp. CP.
Office	10	48
Office	12	48
Office	14	80
Factory spaces	8	48
Factory spaces	12	80
Factory spaces	16	80 to 200
Factory spaces	25	200

Table IV.—Typical Illumination Intensities Used in Various Installations.

	Intensity
	in foot-candles.
General office	3.5, 3.6 and 4.5
Factory office 2.9,	
Drafting work	7.0
General factory work	3.2
Fine machine work	
Factory work where the sur	
are excessively dark and	
light is required	6.6

By working out the intensities at the various points "A," "B," "C," "D," "E," "F," "G" and "H" on Fig. 6, an intensity of about 3 foot-candles has been found to result. This shows the calculations as based on the "utilization efficiency" to agree very closely with that of the point integration method. A slight discrepancy between the two results could easily be explained on the basis of the extra illumination afforded from ceiling and wall reflection, which is not taken into account by the point integration method.

CONCLUDING ITEMS.

By the foregoing treatment of some of the simple practical points connected with illumination design the endeavor has been made to give a working balance between theory and practise. In the past it has been necessary to depend largely on values and constants worked up from experience; but in latter years there has been a growing tendency to make use of constants and formulæ which have been derived under ideal or laboratory conditions. With the accumulation of a large amount of actual data from existing installations it is now, not only possible, but advisable, to make use of such values in the everyday calculation of modern lighting sys-

It may be thought that ideas thus expressed refer only to certain forms of lighting arrangements as, for example, in the case of industrial plants. The ideas herein set forth refer, however, not only to such cases, but also, in a general way, to the entire range of illuminating engineering problems.

It is hoped, by a treatment of this kind, to encourage the use of practical working data based on performance values, and it is further hoped that in the publication of constants, they may be modified and revised in a way which will include average

performance conditions.

It may be stated by some that allowance is made in such published values to include deterioration, both from surroundings and from dirt accumulations. This to a large extent is true, but in a large number of cases the man on whom falls the responsibility for laying out lighting systems is apt to be misled if the constants in such a table are given the foremost place in the pamphlet or in the rule book, with a simple statement that certain modifications must be made if the surroundings are dark, and if dirt accumulations are excessive. It is rather believed that average performance conditions should be given a most important place in such rules, and in the actual work associated with practical design calculation, and that their importance warrants them receiving as much attention as in the case of "utilization efficiency" constants derived under ideal circumstances.

Illumination design calculations based on practical working data, as just described, are apt to result in more satisfactory installations on the average than can possibly be the case if the installation is worked out with the most meagre number of lamps possible to obtain a given condition when the installation is new and clean. It is believed, therefore, that the incorporation of due precautions and modifications in work of this kind, including all the various items, will result in a distinct advance to the field of illuminating engineering.

Hospital Lighting

By WILLIAM S. KILMER.

Under the above caption of "Hospital Lighting," Mr. Kilmer has contributed a series of three articles including the present one on the lighting of "The Operating Table," the second on the lighting of "Hospital Laboratories," and the third on the lighting of "Hospital Wards."—EDITOR.

1. The Operating Table:

To treat the subject of hospital lighting in even a partial manner, it is necessary to subdivide the subject into two classes—namely, the localized or specific illumination of operating rooms, laboratories, beds, etc., and the general illumination of wards, corridors, etc.

For satisfactory results, the surgeon requires an average illumination of 30 foot candles on the operating table; this, of course, to be produced with a minimum variation in temperature. Figs. 1 and 2 show the details of fixtures designed sole-

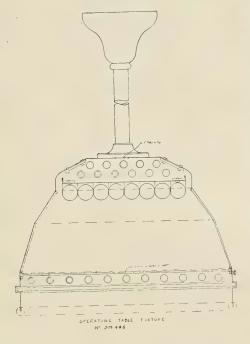


FIG. I.—AN OPERATING TABLE UNIT DESIGNED FOR USE WITH LINOLITE LAMPS.

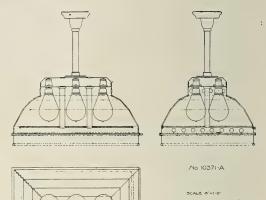


FIG. 2.—A UNIT DE-SIGNED FOR USE WITH BULB LAMPS.

ly to meet the above described conditions.

Fig. 1 shows a fixture designed and built exclusively for the tubular Linolite lamp. Eight 35-watt tungsten units are recommended for the most satisfactory results.

To reduce the heat generated by the lamp to a minimum, the fixture has an ingenuous arrangement of double glass slides, by which a forced draft is created by the heating, and consequently raising the air between the glasses, the heated air passing out of the fixture through the vents at the top. This syphon arrangement is ofttimes assisted by the use of suction pumps.

Under actual working conditions, temperature tests show the following results, with the mercury 9 inches below the lower plate glass:

	rees
F	ahr.
Temperature of room	78
Fixture after one hour burning with	,
slide	81
Fixture after one hour burning with	
no slide	87

Fig. 4 shows the characteristic distribution of light about this unit. For best working results, it should be installed 6



FIG. 3.—A SPECIAL UNIT DESIGNED FOR USE IN THE GERMAN HOSPITAL, NEW YORK.

feet 6 inches from floor to lower edge of frame.

Fig. 2 shows the detail of a fixture with the same principles of construction, but built for six 100-watt tungsten Edison base lamps. The characteristic distribution of the light is shown in Fig. 5. Temperature tests under actual working conditions show the following results, with mercury 9 inches below the lower plate glass slide:

						De	grees	
]	Fahr.	
Tempe	eratu	re of	room				. 76)
			burning					
After	one	hour	burning	with	no	slide.	. 94	

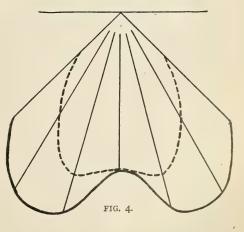


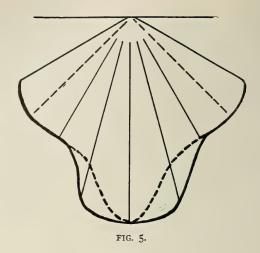
Fig. 3 is from a photograph of an installation in an operating room of the German Hospital in New York City.

These fixtures are mechanically constructed free from cracks and crevices, which render them easily cleaned. The exterior standard finish is baked white enamel. Silver-backed rippled glass constitutes the reflecting surface.

The color of the light emitted by either of these units varies 4 per cent. from the spectral percentage value of daylight.







The Gas White Way in Manchester, N. H.

How an Obscure Back Street was Lifted Into Prominence by the Use of "More and Better Light"

The propriety of the doctor taking his own medicine and the preacher practising his own precepts has been often reiterated, and failure in these two respects has been considered good grounds for suspicion of the ineffectiveness of the prescriptions and sermons. The producers of electric current have generally made consistent use of the moral effect of using what they try to persuade others to use. You do not need to look for a central station or an electric lighting company's office with a lantern; the location of the former is usually proclaimed by an electric sign of huge dimensions, and the latter by an illuminated show window which stands out from its neighbors as far as unobstructed vision permits.

How many gas works have you seen displaying an illuminated sign at night? And how frequently, by comparison, do you find brilliantly illuminated display rooms on prominent thoroughfares? To be sure, the aggressive competition of the electric interests has induced some of the gas companies to display their wares in an attractive manner and in prominent locations, both by night and day; but there is yet much to be done before they will even

approach the electric interests on the whole in this respect.

An example of the direct results of the display of gas illumination by gas companies is to be found in the street lighting installation in Manchester, N. H. This had its inception in the installation of five gas arcs in front of the office of the local gas company. The immediate result of this was to throw the adjacent streets into comparative darkness, although they had the ordinary amount of illumination generally provided. The prominence which this bright spot at once achieved attracted public comment and interest among the merchants in the vicinity. The inevitable result followed; the merchants agreed to bear the expense of the service, and similar posts, which are of a handsome decorative design, each bearing an inverted gas arc, were installed on what had previously been a secondary and comparatively obscure street, thirty-two posts in all being installed, fitted with Humphrey fivemantle inverted arc lamps. This illumination at once entirely changed the character of the street, placing it first in prominence, instead of the obscure position which it had formerly held.

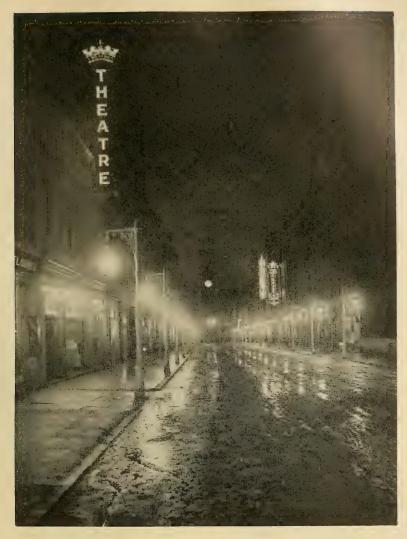


FIG. I .- HANOVER STREET, MANCHESTER, N. H.

night view of this street shown in the illustration indicates clearly enough a condition which could not help but prove a distinct attraction at night. The merchants on the street are delighted with their investment, and their fellow merchants on other portions are actively seeking the same proof. Thus the total result of the example set by the gas company itself will eventually be a better lighted city throughout, with gas illumination maintaining its position as a first-class luminant for either exterior or interior use.

Some New Fixture Designs by an Eastern Maker

The chandelier has had its day. By this we mean that the type of lighting fixture which had its origin in the support for candles, and consisted essentially of a central supporting stem to which were attached various arms for holding the light-sources, is passing away as a result of the conditions and ideas brought about by modern illuminants and accessories.

The art of glassmaking has been as greatly improved, since the time when the candle was the premier light-source, as have the illuminants themselves. Art metal work also, if not improved in point of artistic conception, has at least been enormously popularized by the development of processes of reproduction whereby



FIG. I.—A COMBINATION "SHOWER" AND SEMI-INDIRECT EFFECT.



FIG. 2.-A "SHOWER," WITH "STAR." EFFECT.

the cost has been brought to a point that places it within the reach of the masses.

While we may concede to our foreign neighbors even a superior talent in artistic design, we must reserve the claim to superiority in general workmanship, especially that which pertains to mechanical construction. The Americas lighting fecture, even of the cheaper and more unpretentious design, shows good mechanism and possesses that finished appearance which is the mark of thorough workmanship.

The art of glass-making has also been brought to a much higher state of perfection along certain lines in this country than anywhere else in the world. Even the simplest possible forms of decorative



FIG. 3.—AN ART NOUVEAU "SHOWER."

glass for use with light—viz., the prisms and spangles that were practically the sole means of fixture decoration in the days of the candle—are so much better made today that the older pieces look crude and archaic. In fact, when broken pieces are to be replaced, or additional pieces added to the old "lustres," the glass-maker today finds that he must imitate imperfections in the color and transparency of the glass.

In the application of color effects to lighting glassware as much progress has been made as in the dyeing of fabrics, and, as everyone knows, this has been revolutionized within the past half century; and also, as in the case of fabrics, the processes have been so cheapened as to bring the most beautiful productions within the reach of the average buyer.

The modern lighting fixture is thus the direct result of progress in natural science.

In Fig. 1 is shown a fixture of the "shower" type, in which the direct illumination by the pendant lamps is supplemented by the semi-indirect lighting from the suspended placque. The decorative treatment of the cast metal work is

in Art Nouveau, and the glassware is of the new alabaster type, the shades with pendant lamps being treated as carved alabaster, with the lower parts slightly stained to enhance the effect. The general effect of the fixture is strengthened by the ceiling placque surrounding the canopy.

Fig. 2 shows another fixture of the "shower" type, with the suspended placque replaced by a heavy metal star which serves to spread the chain supporting the lamps. A large canopy of harmonizing design adds to the strength of this fixture, as in the former.

Fig. 3 shows still another variation of the "shower," of Art Nouveau tendency in design.

We turn now from the most modern to the most primitive school of art metal design. Fig. 4 shows an adaptation of the oldest form of lighting fixture to the most modern light-sources. A ring of wood or wrought metal upon which were placed candles antedates the arm chandelier. In



FIG. 4.-A "SHOWER" IN HAMMERED METAL.

this case the metal ring is used to support pendant electric lamps, while the crudities of primitive craftsmanship have been well preserved in the design and workmanship.

Fig. 5 shows an adaptation of the same general idea, but worked out more in accordance with the demands of the electric lamp. There is always a certain attractiveness about a return to the simple in art as to the simple in life. Even as the Red Man rejoices in returning to his blanket, so there is a certain instinctive pleasure to all of us in turning back to the simplicity of the childhood of the race and the simple delights of the savage. The lighting fixture wrought in the spirit of Tubal Cain will, therefore, always find a place.

Fig. 6 is a fixture on the chandelier principle, but so varied as to be new in its general result. It is entirely devoid of surface ornamentation and shows how much applied art is dependent on form and contour. While only simple curves are used, the lines are such as to give a distinctly pleasing appearance; even the outline of the shades, which in itself is rather uninteresting, becomes decorative

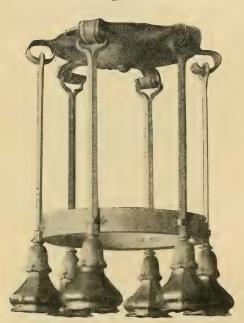


FIG. 5.—ANOTHER "SHOWER" IN HAMMERED METAL.



FIG. 6.—A SIMPLE AND ATTRACTIVE CHAIN FIXTURE.

when carrying out the general lines of the fixture.

Fig. 7 shows two other designs on the same general principle. While surface ornamentation is used to a moderate extent in these, the general effect still depends upon harmony of line.

Fig. 8 is a chandelier suited to large interiors and is an example of what might be termed ornamental mechanics. The construction is almost as simple as possible and no effort whatever has been made at decoration aside from the few curves which are natural features of the construction itself. Opinions may differ as to the general effect, but it can at least be said that there is no transgression of any artistic or mechanical principle, and this is more than can be said of a great many fixtures which set themselves up as models.

One thing noticeable in all the designs illustrated is the use of small lamps; except in the bowl of the semi-indirect fix-



FIG. 7.—A GOOD EFFECT IN A CHAIN CHANDELIER.

ture lamps of the old 16 c.p. size are plainly intended for use. This is a concession to custom, at least to a certain extent. Are these separate light-sources clustered together more artistic than a single source of equal power? That is a question for the user to decide, and the decision will depend upon his tendency to stick to what he has been accustomed to seeing, or upon

his desire to have something new and different, as the case may be. To be sure, the convenience of being able to light up a single unit is of some importance. It is then a case of economy against art, for a cluster fixture with only a part of the lamps lighted is certainly not artistic.

The new high power metal filament lamps have scarcely yet made their influence felt in the design of fixtures for domestic use, but this is the next step in the revolution in lighting that has been going on intermittently for the past hundred years. While the small lamp in clusters will never be entirely abolished, the use of the large unit must inevitably increase, and fixture designers may well have this in view.



FIG. 8.—A STRIKING EFFECT, WITH SIMPLE LINES.





FIG. I.—NIGHT VIEW OF ROTHSCHILDS' EROTHERS' DEPARTMENT STORE, ITHACA, N. Y.

Department Store Lighting With Gas Arcs

By J. M. Coles.

A writer once said that "some men are great because of the things they do, and some things are great because of the men that do them." The aphorism is applied unconsciously in many ways. Coming down to the case in hand, we may say that some stores are remarkable for the lamps they use and some lamps are remarkable for the stores in which they are found. The building of pre-eminence in size or character invariably becomes a standing advertisement for all of the material and equipment entering into it. The latest skyscraper becomes familiar as the public exponent of particular brands of plumbing, hardware, wall plaster, radiators, lighting fixtures and so on through the catalogue. The argument employed is that the building, being entirely new and

first-class, contains only the most modern and approved appliances, a conclusion which is fairly logical, but by no means universally true. This latter observation applies especially to the lighting. It is no uncommon experience for the first tenant in such a building to have the lighting arrangements completely overhauled for his use before he can satisfactorily occupy the premises. On the other hand, the building that is old enough to be outof-date in its general construction, and inconspicuous enough to be entirely overshadowed by the latest creation, may have such intelligent discrimination displayed in the adaptation of modern conveniences to its special needs as to furnish an instructive example.

The department store of Rothschilds'

Bros., Ithaca, N. Y., is in a way an ex-While the ample of this latter kind. building occupies one of the most prominent corners in the city, it is by no means modern in construction, and the store has overflowed its original bounds and spread into adjacent structures even less pretentious. The store is in itself larger, both in space and volume of business, than any other establishment in the town, and this position has been obtained from a very small beginning some twenty-five years ago. It follows, therefore, that these merchants must have succeeded in continually attracting the public. The illustration, showing one of the departments, is evidence that they have not neglected the importance of illumination as an attraction for customers. The two standard illuminants are still in evidence—that is, the electric arc and the gas arc. But in this case the gas arc is doing the honors, while its competitor is serving as the alternate. The general illumination throughout the room, on the highest shelves as well as the counters and tables, is perhaps the best explanation of this use of lamps. That the choice of illuminants is not dependent merely upon economy may be also gathered from the fact that the gas installation is the more recent, and hence entailed the expense of a new outfit. The installation consists of three-mantle and five-mantle Humphrey inverted arc lamps.

While this installation would not be cited as remarkable on account of the store in which it is located, the fact that the gas arc has been put into entirely satisfactory service in an establishment of a type of thousands of others throughout the country, and by a progressive merchandising firm, is worth considering by the other establishments of the same type. Not all business is done in modern palaces; a great deal-probably the larger part-is still going on "at the same old stand," and the problem of making the old stand attractive is quite as important as the glorification of the newer and more pretentious structure. Fortunately, the feature having most to do with the attractiveness of a store can be easily and cheaply brought up to the highest modern

Every store can have good light.

Some Points for Consideration when Remodeling Old Lighting Installations

How One of the Large Lighting Companies Looks After Its Customers

By G. BERTRAM REGAR.

The value of good illumination is imperfectly realized by the average business man. From the financial standpoint it is an asset of efficiency. It is the means of bringing about the greatest output with the smallest loss. It is a satisfaction to your customers, your employers, and yourself from healthful, comfortable, and pleasing standpoints with no worry or annoyance, and is the means of procuring the necessary amount of illumination at the lowest cost.

The merchant as a rule is slow to see the advantages, especially from the psychological standpoint, of a well lighted shop. He will take pains to see that his plate glass window is kept immaculate,

perhaps first and most important, because of his desire to give a neat and businesslike appearance, and yet how often the same business man will permit the lamps and reflectors of his lighting installation to become grimy and dirty. It is quite true they are not so noticeable as the window, but it is a fact that there is an absorption of the light by this dirt, with the resultant loss of the intensity of the illumination, and therefore a loss in efficiency, because it is costing just as much energy to get this flux of light, which is being wasted. Sooner or later he realizes that his place does not have the attractiveness of his neighbors, and that it is expensive to light. In many cases he sees little

more in the problem than installing a sufficiently powerful light in the center of his room, and perhaps several side lights around the sides of the room. No thought is given to the many important factors bearing on good illumination, such as the flux of light required to give sufficient intensity of illumination on the plane to be lighted; the kind of illuminant in order to get the results best suited for the work; the diffusion of the light, in order not to cast shadows, and to enable us to see well with the intensity of light furnished, and to avoid a harmful effect both from a physiological and psychological standpoint; the color scheme of the walls and ceilings, which is so highly essential.

It is not the purpose of this article to treat the subject of good lighting or illuminating engineering on technical lines (there being many books and papers written), but to endeavor to put before the merchants in a concise, clear way some

facts for his consideration.

Conditions have materially changed, scientific management is of paramount value. The very simple factor of improved transit facilities has been the means of taking the people from their local stores to the centralized stores of the city. This must be counterbalanced by the local dealer, by making his store attractive to his customers, and by the practise of economic methods. The increased central business is the means of more establishments being maintained, and the consequent necessity of the same practises as are necessary for the smaller store, in order to at least hold and to gain business, owing to increased competition.

The development of more efficient methods of lighting has been coincident with the increasing pressure of higher labor and material costs in all lines of manufacture. Economies are eagerly sought after and put into effect. Waste is a lost asset. Lack of light has undoubtedly caused a large amount of waste, of human

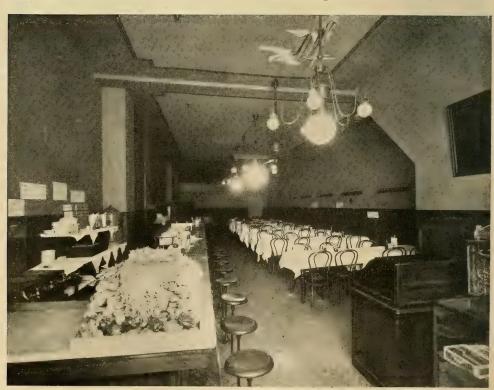


FIG. I.—A RESTAURANT INSTALLATION, WITH HIGH CANDLE-POWER ARC LAMPS IN DIRECT RANGE OF VISION.



FIG. 2.—THE REMODELED INSTALLATION, USING MAZDA LAMPS, HOLOPHANE REFLECTORS AND CEILING FIXTURES.

energy, and of material. As labor has become more valuable and more independent, the comfort and well-being of employees have been seen by the more broadminded to create a valuable asset in the lessening of these class differences, which caused much economic waste. Well lighted, well ventilated shops make for peace of mind, and are very important factors of efficient organization.

Artificial light is used for the purpose of seeing and distinguishing objects clearly and comfortably. It is necessary not only to have sufficient intensity where it is needed, but also to keep it as low as permissible wherever it is not needed, so as to afford to the eye rest from fatigue. Objects are seen and distinguished by differences in color and in intensity of the light reflected by them. If there were no differences in color or intensity, one would see light, but would not distinguish objects. The minimum intensity must be sufficiently high to see clearly, and the

maximum intensity not so high as to cause fatigue.

When exposed to fairly high light the nerves of the eye decrease in sensitivity by fatigue, and inversely in lower illumination. The pupil of the eye is almost instantaneous and adjusts the power of seeing against excessive brilliancies, while the fatigue is a gradual adjustment to the average intensity of illumination, within

the range of the human eve.

When exposed to high intensities, however, the eye's sensitivity decreases, and the illumination appears darker. Glaring examples of this are seen where single units of high intrinsic value, such as arc lamps, or high candle-power incandescent electric or gas lamps, are installed at a low elevation above the plane to be illuminated; also the usual lighting fixture with the sockets on an angle equipped with clear lamps usually several inches above one's head; the average drug store window installation, where two bare lamps



FIG. 3.—A GROCERY STORE. FIXTURES TOO LOW AND IN DIRECT RANGE OF VISION.

are installed on side brackets. All these cases show the light-source directly in the range of vision. Also the use of drop cords with metallic cone reflectors, installed over desks, machines and workbenches, with an absence of general illumination. This last mentioned case is an almost common practise and is exceedingly detrimental to the eye-sight, owing to the sharp contrast between the brightly illuminated working plane and the surrounding darkness. Therefore, it is evident that an installation scientifically made, giving a certain intensity on the working plane, appears to be more brilliantly illuminated than the same intensity if from an installation incorrectly made, the reason being that the visual acuity has been decreased.

For satisfactory illumination direct light is necessary to mark the edges of the objects by their shadows, and at the same time diffused light is necessary to see clearly in the shadows. Therefore, the use of a single unit gives us direct light, whereas with a number of units, correctly located, we get a crossing of their light flux, and a light coming to the object from all directions, the diffusion being greater with the greater number of units. To this must be added the light reflected from ceiling and walls, which is diffused light. The proportion of the direct light which is reflected from ceiling and walls depends upon the reflecting power of the ceiling and walls—that is, with their brightness or darkness.

Central stations throughout the country realize the value of co-operating with their consumers in the matter of obtaining efficient illuminating conditions, realizing the power it exercises on the existing business and its value to prospective business.

In the case of the Philadelphia Electric Company, an illuminating engineering department has been in existence for several years as part of its commercial system, and continually, through its publicity department, is offering to its consumers the services of its illuminating engineers free of charge.

The scope of the illuminating engineering department is very broad. It will design the lighting of new buildings or buildings being remodeled. It will, after careful consideration, offer suggestions for changes of existing installations. It cooperates with the architect and the contractors, so that all may work together for the mutual benefit of customers and the company.

Above all, it is the desire to secure the confidence of its consumers and to have them know that they are entitled to the same courteous treatment from the company as he may expect from any first-class merchant.

A very interesting example was recently demonstrated at a Chestnut Street drug store. The store is located on a southeast corner and faces north. The side walls

have shelves to a height of 9 ft. 6 in., and above the shelves, on the street or west side, are windows, while on the east wall and ceiling was a soiled dark green felt paper. The rays of natural light passed through windows directly across the store and gave sufficient illumination to the east side, but it was found necessary to install several side brackets along the west wall. which were in use all day. The whole lighting installation, while ornate, was inefficient, and our services were requested. One of the chief recommendations was the repapering with a light buff paper, with the result that it not only aided the artificial lighting when in use, but made the use of the side brackets, which had been ordered removed, entirely unnecessary during the daytime. The light, passing through the windows against the light walls and ceiling, was evenly diffused over the whole store. The result was efficiency, economy and artistic effect.



FIG. 4.—THE REMODELED INSTALLATION. FIXTURES SHORTENED. CARBON LAMPS REPLACED BY MAZDA.

The first two illustrations show a comparison of the before and after taking of the lighting of a restaurant. The original electric lighting installation consisted of three 5-ampere arc lamps, and the gas installation of fifteen inverted gas lamps, each installation being used at certain seasons of the year, according to climatic conditions.

The electric lighting installation was extremely poor. The lamps were in the direct range of vision. At certain periods of the day when the addition of some artificial light was needed, and one arc was turned on, the result was a glare of light at one spot, and the objection of decided black shadows.

An installation of ceiling sockets, equipped with Mazda lamps, and Holophane reflectors, was recommended and made, with the result that by the means of several circuits several different intensities can be had. A soft, even diffusion is the result, and the connected load was reduced about 35 per cent. This was pleas-

ing to the consumer, and the central station got twelve months' service instead of five.

Fig. 3 shows the lighting units installed low and in the direct range of vision. The upper part of the side cases showed a falling off of the light flux. Only a very inexpensive change was necessary. The fixtures were raised, and a 45-degree angle fitting installed above the sockets, thus bringing the lamps to a vertical position. Mazda lamps replaced the carbon lamps. The result was a pleasing light to both customers and employees. The current consumption was slightly decreased, and the store had the apparent effect of looking larger, as shown in Fig. 4.

Figs. 5 and 6 portray an incorrect and a correct method of saloon lighting.

Fig. 7 illustrates an inefficient window installation. The units were four 60-watt and one 100-watt Mazda lamps. The light was directly in the range of vision, and owing to its intensity caused eye strain, with the result that the display



FIG. 5.—A POOR CAFÉ INSTALLATION.



FIG. 6.—AN EXAMPLE OF GOOD LIGHTING FOR CAFÉS. FIXTURES HIGH AND OUT OF RANGE OF VISION.

appeared darker than it really was. The greater amount of light flux, being back of the center line of the window, cast shadows on the goods displayed near the front, and the majority of this flux was wasted in lighting the rear side of the goods displayed.

Fig. 8 shows the same window illuminated with mirror cone reflectors placed next to the glass, and each equipped

with six 60-watt clear Mazda lamps. The light source is completely hidden and the eye of the observer is in perfect relief. The light is reflected directly on the front or display part of the goods. The current usage was very slightly reduced, the intensity of the illumination increased, and the power of seeing the display was materially improved.



FIG. 7.—A WINDOW LIGHTING INSTALLATION WITH LIGHT-SOURCES VISIBLE, DETRACTING THE EYE FROM THE DISPLAY.



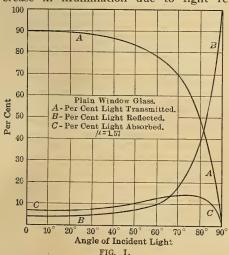
FIG. 8.—THE SAME WINDOW WITH LIGHTING UNITS CONCEALED.

Reflection from Plate Glass

BY RALPH BEMAN

How much effect does the reflection from plate glass in a show window have on the distribution of artificial light in the window? On the average we may say that it has very little effect. As a matter of fact, the only windows in which plate glass reflection is of much importance are those which are exceedingly narrow and in which lighting units are placed close to the glass. The mounting height of lamps in windows, as well as the dimensions of the windows themselves, vary widely, but common practise is to arrange the lighting system so that the light will come from the upper front edge of the window.

Reflectors for use in window illumination are generally so designed and so placed that very little light reaches the glass. Of course there are illuminated signs, but when the percentage of light thrown against the sign is compared with the total quantity of light emitted by the unit, it will be found to be very small. Even where concentrating prismatic reflectors are used close to the glass, the increase in illumination due to light re-



flected from the glass is almost negligible 12 in. back from it. The angles within which most light is reflected lie close to the glass. The farther away from the glass the units are placed, the less the effect of reflection and the greater the transmission into the street.

Considering installations of glass reflectors of the prismatic and the so-called "milk-glass" type, the greater portion of the light which does reach the plate glass goes through into the street. When these units are placed at the position of greatest reflection from the window glass—viz., close to the glass—the effect of that reflection is very small when compared to the direct light from the units and is of noticeable value only near the front of the window.

The use of curtains and grill work to conceal the light-sources in a window from persons on the street is quite common to-day. Besides concealing the light-sources they cut off any light which may reach the upper portion of the plate glass; furthermore, they return to the window but little of the light which falls on it. The point to be made in this connection is that the light which does reach the plate glass does so at a very oblique angle and hence will be reflected to a point on the window floor close to the glass.

The group of curves shown in Fig. 1 will show the percentage of light reflected, transmitted and absorbed for light rays striking the plate glass at various angles. A study of curve "B" will show that the percentage of reflection does not amount to much with angles of incidence below 60 degrees, while quite a large percentage of light is transmitted even up to 70 degrees. Above this point the percentage of reflection increases very rapidly, while the percentage of transmission and absorption fall off.

EDITORIAL

The Sane and Electric Fourth of July

This is the age of reform. So plentiful are the new "isms" and principles that unless one embraces a new departure at least once a week he can lay no claims to belonging to the glorious hosts of progressives, but must take his place in the forlorn ranks of standpatters or reactionaries. It would seem that we should get all forms reformed, and have it over with at this rate; but the trouble is that the reform itself has to be reformed. And so, like the fleas of the poet that "have smaller ones to bite 'em," we go on ad infinitum.

We used to count the days from Christmas until we should have free license to blow off our fingers, put out our eyes, and tattoo our faces with burnt powder on the glorious Fourth without let or hindrance. But the reform has struck this sacred privilege, and we are now regulated out of the opportunity to mutilate our bodies and enjoy the novelties of lockjaw.

The Sane Fourth is upon us.

The electric light, which has contributed so much to the enjoyment of our lucid intervals heretofore, is to rightly have a prominent part in reducing the periods of The old-fashioned fireworks insanity. were great spectacles in their time, but that was before the days of the electric light, and it is no mere boast or fancy to state that electricity has won supremacy in this field. Probably the most gorgeous display of pyrotechnics ever produced in this country was in New York Harbor during the celebration welcoming Admiral Dewey on his return from Manila; and yet those who remember the glories of this occasion must, on thoughtful consideration, grant that the electric displays were the more impressive and spectacular. The Hudson-Fulton celebration is a more recent and convincing demonstration of the possibilities of spectacular illumination with electric light. It is not at all surprising, therefore, that New York City should make large use of this safe and sane substitute for the old-time dangerous and costly fireworks. Doubtless other cities will also utilize the same effective means of display, for the idea of the Sane Fourth has gained general acceptance. The same amount of money that is burned up in chemicals for pyrotechnic displays would produce electrical illuminations that would be more pleasing and far more enduring.

Let us have more of the Sane and Elec-

tric Fourth!

Searchlights for Merchant Vessels

The lack of sufficient lifeboats on the *Titanic* to carry passengers and crew was the most shocking revelation of the negligence of the operating company to safeguard the lives of its patrons and employees. The lifeboat has been an emblem of refuge in time of storm and disaster since men first "went down to the sea in ships," and the failure to provide this ancient means of possible escape from perils by water instantly appealed to everyone—to those who had never seen the ocean as well as to the seasoned mariner.

No one will question the advisability of providing every possible means of safety against disaster, but also no one will question the greater wisdom of providing means for averting disasters themselves. A lifeboat is a good thing when the ship is sinking, but a floating ship is a far better thing.

In the appalling loss of life in the *Titanic* disaster it was natural that the value of the ship and cargo should be quite lost sight of; but let us suppose that sufficient lifeboats had been provided, and that the entire human cargo had been rescued, then the loss of the most magnificent ship that ever sailed, with her valuable cargo, would have been a calamity of no small moment. To the engineer, and even

the thoughtful layman, the most obvious, simple, inexpensive, and efficient means that could possibly have been added to those with which the ship was provided to avert a disastrous collision was omitted, and, stranger still, this omission was not peculiar to this particular vessel but common to the entire merchant marine of the world. This protective device is the familiar searchlight. Why merchant vessels have never been equipped with this effective pathfinder is one of the inscrutable mysteries of human action. searchlight is in general use by the navies of the world and on boats of every size and description plying inland waters, and why it should be thought unnecessary to equip ocean-going vessels in the same manner simply passes understanding.

The report of our own Senate inquiry into the disaster contains the sensible recommendation that all ocean-going steamers be equipped with searchlights, but the testimony before the British Investigating Committee does not unanimously agree upon this point; in fact, some very outright opposition to the use of searchlights has developed. This flying in the face of Providence would be difficult to comprehend on the part of a civilized nation if we did not stop to consider that it comes from the same source as that which sent its own "Pride of the Seas" across the water with such a stubbornly arrogant conviction that it could not be destroyed by the powers of nature that it was rushed full speed into a known field of icebergs. Those who confidently believe that they have absolutely conquered nature must logically hold that they possess all knowledge, and cannot therefore admit error in judgment in any respect.

It is highly pleasing to note the sane and sensible view taken by the largest ship-holding company in the world, the Hamburg-American Line, the finest vessel in whose fleet on her last entry into this port was equipped with the largest and most powerful searchlight obtainable, and that the navigators declared it highly satisfactory. It is stated that it rendered objects distinctly visible at a distance of five miles, and although it encountered a light fog on entering the harbor, its approach was seen a long distance away.

There is not a shadow of a doubt that such a searchlight on the Titanic would have revealed the presence of the iceberg at least this distance away, which would have given ample time for the vessel to have safely cleared it.

There was a story in the old school readers setting forth how for want of a single horseshoe nail both horse and rider were lost. The moral of this story will apply literally to the Titanic disaster for want of a light both vessel and 1,500 human beings were wiped out of existence.

Art and Science in Illumination Actually Getting Together

As an indication of a healthy growth on the part of the lighting interests, one fact of particularly recent development stands out as of more importance even than the recent discussion as to the change of the name of the Illuminating Engineering Society to some other which would include artistic design and conception. Perhaps there is a certain significance in the simultaneity of the consideration of the society named, and the fact that the larger fixture manufacturers, especially here in the East, are actually taking up illuminating engineering seriously and systematically. Long ago-years ago, it seems—this publication pointed out in the utmost sincerity that the fixture industry was in so powerful position to better conditions that there should immediately be within the service of every concern engaged in installing fixtures, illuminating engineers who would and could see to it that buildings were lighted efficiently and economically, as well as artistically.

The house owner, the architect, and the fixture manufacturer are necessarily closely related. As one evidence of the former deplorable apathy to illuminating engineering on the part of architects and fixture dealers are to be found to-day throughout the entire country buildings that are equipped with costly and perhaps artistic fixtures which are productive of exceedingly poor illumination—so far as the consumer is concerned. If all this movement toward more intelligent use of light is not for the benefit of the consumer

what excuse is there for it?

As a matter of fact, however, illuminating engineering is a science which renders direct benefit to the people. Every movement which has thus benefited the people has succeeded; movements designed to benefit only the few have invariably failed.

Illuminating engineering, in the broader conception of the phrase, has been developing at a constantly increasing ratio. First, there was a corporal's guard, a veritable handful of men who really understood illuminating engineering, and saw what a benefit it would become to mankind when generally recognized.

Next came the flock of "would-bees," of whom perhaps the worst that can be said is that they were immature. These are finding their own respective levels—and of some it certainly can be said that they have not only absorbed much that the others knew, but have added to it.

Now, it rather looks as if the number of really practical, competent illuminating engineers was growing at a greater rate than ever before; and, what is more to the point, they are becoming recognized in the light of their proper worth by manufacturers of the various appurtenances which enter into the accomplishment of what one puts it: "There is good lighting for you!"

"The Blight of the Gas Tank"

The above caption appeared several months ago in one of the Reviews, under which it quoted from an article in an engineering publication, setting forth the abhorrence which people have of the familiar gas tank. The statement was quoted that the unsightliness of the gasometer exerts a blighting influence upon all surrounding real estate. The remedy proposed was the elimination of the gas tank from the city and the erection of the gas holder and works at some point where it would not be observed by the populace.

That the writer had a good basis for his contention no one will dispute. "The gas-house district" in any city is a term synonymous with a slum. The contrast between the ideas associated with the production of gas with that of electricity is interesting. The central station has never attempted to conceal its presence or hide

itself in a suburb. It seeks a location convenient for the receipt of fuel and the distribution of its product, and has never been considered any more of a detriment than a factory of the better class; and its location is generally blazoned forth in a sign of its own wares.

Now, there is no reason in the conditions essential to the manufacture of gas why the gas works would be any more unsightly than a central station. As for the gas-holders themselves, which in the large cities are distributed at various convenient points, like the sub-stations of the electric generating plant, they could be rendered entirely unobjectionable, if made to improve the general aspect of their neighborhood. Undoubtedly if we could begin all over again with our present knowledge and engineering facilities, we would generate gas at the coal mines or as near thereto as possible, and transport the finished product instead of the raw material. But gas works are expensive properties, and the best must be made of what are already in existence. Nothing in itself is more innocuous than the gas tank. As the scientists would say, it is tasteless, odorless and noiseless. Its only failing is its inherent ugliness of appearance. Its circular shape alone is offensive. for some curious reason; even a circular or octagonal building is displeasing.

The cure for this one defect is simple. The reader has already probably guessed it. It is merely to enclose the round tank with a square wall similar to the ordinary building. In most cases sufficient room could be included in this enclosure to return a very good interest on the investment. Where new tanks are to be erected sufficient space could be left between the tank and the walls for a tier of rooms, which would be well lighted and valuable for light manufacturing, office or storage use. The objectionable round tank would thus disappear and in its place would arise a large structure of the accustomed type. In many cases it would probably be a firstclass speculative investment for the gas company to purchase all the available property within a radius of several blocks of the gas tank, then cover the tank in this manner and reap the profits from the

increase in realty values.

There is thus no reason, either economical, scientific or engineering, for the reproach of the present time of the "blight of the gas tank."

New York, May 20, 1912.

To the Editor:

Under the caption, "An English View of American Decorative Street Lighting," in your last issue you quote from the Electrical Review, London, about as amusing a bit of nonsense as has reached my attention in many a long day.

The London publication, which states in part: "But we must confess that we are wholly unable to share the author's enthusiasm for the beauty of these designs, some of which, in fact, we should not hesitate to call atrocious. . . . Whereupon reference is made to Fig. 7.

To be sure, your comment explains the astonishing ignorance on the part of our English friends to assume that the lighting standard (Fig. 7) which they so poorly reproduce, should be considered in good



ILLUSTRATION FROM "ELECTRICAL REVIEW," LONDON, REFERRED TO AS A STREET LAMP-POST.



THE POST UNDER DISCUSSION. SHOWING ITS LOCATION ALONG THE PORTICO AT HOTEL COTHAM, NEW YORK.

taste for using as a street lamp post in this or any other country.

Thinking that some of your readers, who saw this distorted thing reproduced in your publication, would like to see how the standard actually looks, I am sending you a photograph. By what means or other the editor of the London Electrical Review contrived to distort the standard is difficult to imagine. The writer barely recognized it as one of those extremely artistic decorations used as lighting standards about Hotel Gotham here in New York. Their illustration not only shows the standard out of proportion, but gives a fantastic effect to the glass balls.

To be sure there are, perhaps, many lamp post designs in our country—and ornamental lighting standards as well-which are not all they should be; however, there is surely nothing, so far as the writer's knowledge extends, to warrant our English friends talking about our "atrocious" designs when they cannot tell a decorative lighting standard from a street lamp post.

Yours very truly,

M. J. MORONEY.

TECHNICAL SECTION

SOCIETIES

The 1912 N. E. L. A. Convention

Seattle, Wash., during the National Electric Light Association Convention—June 10 to 13, inclusive—was the thinking centre for many men of brilliant minds all bent on the same subject, the promotion of the electrical industry.

Seattle, Wash., for the benefit of those who have never been there, is as hospitable as it is bustling, and that is saying much. Beautiful unto itself and with its rugged environs, it offered especially those who attended the convention from the East a delightful place both for enjoyment and for business. Such a place must needs have an inspiring effect on men whose lives are spent amid the commonplace surroundings of the ordinary city or town. The trips out and back were alone worth taking, to have and to hold as a memory to be cherished. The Puget Sound Traction, Light & Power Company, Seattle Electric Company, and the various other lighting companies, were the entertainers "of record," while other of the large manufacturing and operating organizations in the electrical field had all manner of entertainment provided for the members and their ladies.

The discussion of the relation of the central station to the public received possibly the most exhaustive discussion by the 1473 present, unless it might have been the attention given to the promotion of the sale of electricity, in connection with commercial and scientific development and the use of the many new devices for home and industrial purposes.

The 1912 N. E. L. A. Convention was a success in every particular. There was more work than play—although enough of the latter to make the visit pleasant. As an instance of the work actually accomplished, during three days of the con-

vention 30 sessions were held. Of course no one could have been present at all these sessions, but it was noted that a large number attended all that time would permit, not only to embrace the opportunity of the meeting set for each one separately, but to keep in touch with the allied features of central station developments as well.

An important constitutional amendment was made in accordance with the recommendations of the Committee on Constitution and By-Laws. Mr. F. W. Frueauff, of New York City, its chairman, recommended the admission to class D membership of electricians, electrical, and mechanical engineers, manufacturers, publishers, bankers and brokers, or others who are directly or indirectly concerned in electrical progress. No little interest was attached to the awarding of the Doherty medal. This was awarded, as announced by one of the previous presidents, W. W. Freeman, to Mr. C. N. Duffy, of Milwaukee, Wis. Messrs. C. J. Russell, of Philadelphia, and Egbert Douglass, of Milwaukee, Wis., received honorable mention. The following were elected to office for the ensuing year: President, Frank M. Tait, Dayton, Ohio; first vicepresident, J. B. McCall, Philadelphia, Pa.; second vice-president, H. H. Scott, New York City; treasurer, W. W. Freeman, Brooklyn, N. Y.; members of the Executive Committee for three years, J. A. Britton, San Francisco, Cal.; C. E. Groesbeck, San Diego, Cal., and C. A. Stone, Boston, Mass., for Executive Committee, member for one year, filling Mr. Scott's unexpired term, R. S. Orr, Pittsburgh, Pa.

One of the pleasant events of the convention was the rejuvenation of the Sons of Jove, held June 12, which was held in one of the rooms of the Armory. Eighty-

eight members were initiated into the rites of the order. After the rites had been performed a number of "high-up" Jovians made speeches. Among them were John F. Gilchrist, the retiring president for 1912 of the N. E. L. A.; Frank M. Tait, its new president, and J. Robert Crouse.

There were excursions in all directions, coming and going, which contributed to make the convention of 1912 long to be remembered.

Four Permanent Committee reports on subjects directly connected with electric illumination were presented at the recent convention, as follows: "Competitive Illuminants," "Street Lighting," "Advertising and Decorative Street

Lighting," and "Lamps."

The subject of "Competitive Illuminants" is obviously a delicate one to handle, and the report is as sure to displease a certain contingent as is a political platform. The report of this committee at the New York convention last year was particularly vulnerable, judging from the assaults made upon it in the discussion at the convention itself, and through various periodicals later. The salesman that overstates his own case, or even unwitmisrepresents his competitor's goods, invariably finds himself in trouble and on the defensive. The committee this year apparently realized the difficulty of making numerical comparisons between illuminants, and has devoted its report more to the general principles of competitive salesmanship, as indicated in the first paragraph of the report:

The most successful method for the electrical solicitor to pursue in securing business where non-electrical illuminants are in use is in no way different from that which should be employed when no competition is present. He should make a careful study of the needs and preferences of his prospective customer, and then, without regard to the existing installation, design that lighting system which he believes will best meet these particular requirements.

A plea is then made for good illuminating engineering, and encouragement given to the solicitor to undertake the work:

It is quite within the ability of the average solicitor to plan an installation which will give satisfaction. He should first determine the area of the store, and then, with his knowledge of the watts per square foot necessary to meet the local standard of illumination, decide upon the wattage to be installed. Having the dimensions of the store, he will find no difficulty in determining the number of units among which this total wattage should be distributed and the type of reflector which should be used in order to secure a uniform and pleasing illumination.

Where competition exists the salesman should exercise even more than usual care to insure that the system which he recommends is not wasteful and that the wattage which he deems necessary is distributed to

the best advantage.

Where gas is the competitive illuminant the cost of operating the installation should be taken from the actual bills rendered. The fact that the open flame gas burner is still largely used is pointed out. The following paragraph of the report should afford the gas companies food for serious thought:

Many advantages in addition to its simplicity commend the method of basing comparative costs on actual installations rather than on candle-power distribution curves and the like. Thus, an efficiency of from 15 to 25 c.-p. per cubic foot is claimed for some types of mantle lamps, but the consumption of gas in open flames which have an efficiency of from 2 to 4 c.-p. per cubic foot forms a surprisingly large proportion of all gas used for illumination; in fact, a statement appeared in the Gas Industry for January, 1912, to the effect that this proportion was as high as 75 per cent. of the gas so used. The results obtained in tests on various types of open flame burners in general use are shown in Table I. Furthermore, many of the mantle lamps are equipped with burners of the cheaper, less efficient variety, and a large proportion are of the old upright type. Fully 70 per cent. of the mantles sold are of the 5, 10 or 15 cent variety. Again, not one installation in ten has been designed to meet the particular requirements of the location in which it is installed, either as to quantity or distribution of light; hence, in most instances, the consumer is using many more cubic feet of gas per hour than would theoretically be required to illuminate his store with the latest type of gas lamp.

If there is still a lingering doubt in the mind of any one interested in the sale of gas that illuminating engineering applies to their industry as well as to their electrical competitors the plain statement of this committee should entirely remove it.

The variation in efficiency of gas lamps as shown by tests made in different laboratories is then dwelt upon, and the depreciation of candle-power of gas arcs even under presumably the best of care is pointed out in reference to tests made in an automobile factory in Detroit, where it is claimed that the depreciation amounted to as much as 50 per cent. below the initial performance, whereas the electrical installation furnishing the same general character of illumination depreciated less than 20 per cent. The following advice is given on this point:

The gas consumption as well as the candlepower of a given type of gas lamp is such an uncertain quantity that the solicitor should invariably determine from the meters the actual consumption of several installations in his own town before attempting to formulate cost comparisons between electricity and any form of gas unit.

The effect of running electric lamps on under and over voltage is then given both in tables and curves. The depreciation of lamps, especially due to collection of dust, is also carefully treated, tables of numerical values being given.

The report concludes with a number of letters from central stations giving their experience, reduced to facts and figures, in regard to the replacement of gas by electric illumination. On the whole, the report is much less open to attack than those previously published, for the reasons given at the beginning of this review. The spirit of the report seems to be that it is not well to indulge in too much stone-throwing, even if the glass of your house is wired.

The report of the Street Lighting Committee deals with the subject of public street lighting as distinguished from the decorative or spectacular lighting systems that have frequently been put in wholly or partly by private enterprise. A large part of the report is devoted to a discussion of the legal aspects of street lighting contracts, with digests of various decisions by boards of arbitration and public service commissions on disputes that have arisen. The efforts of the association to standardize street lighting contracts, beginning with the convention of 1894, are briefly reviewed, and a summary of the present situation is then given. The testing of luminants and street lighting systems is discussed somewhat briefly but comprehensively. The gist of the conclusions reached is as follows:

It must be admitted that there has been a lamentable lack of clearness and definiteness in the usual street lighting contract, often leaving the producer and the consumer equally in the dark as to their reciprocal obligations. The provision formerly so general in these contracts that the company was to supply simply a "lamp of 2,000 c.-p." has given place to at least a specification of the energy to be delivered to the lamp or to the arc, and if it was not considered desirable to prescribe the specific type of lamp or to define the electrical constants which the lamp must have (leaving it open to supply an alternative illuminant), this fact was indicated by requiring the substitute to be of "equivalent illuminating value."

"equivalent illuminating value."
It is unfortunate that many contracts are so worded as to be a serious impediment to progress, practically prohibiting the adoption of new illuminants as the art develops, unless a new contract be negotiated.

It is, of course, desirable in the interest of the municipality and of the operating company that improvements be introduced as soon as practicable after they have become commercially available, having regard, of course, to the existing investment (on which it may or may not have been possible to earn a sufficient return to make it practicable to supersede the old plant) to the cost of making the necessary changes and to the cost of operation and contract price, under the old and new conditions. This is a question of give and take, in which there should be a reasonable and fair distribution, between the parties in interest, of the advantages to be gained, having regard to all the conditions. In many cases the progress in the art has made it possible to make a notable increase in the light with a material reduction in power consumption; but this reduction in cost of current is often largely offset, sometimes equaled by and in some cases more than balanced by increased cost of carbons and trimming, or by other operating conditions, resulting possibly in somewhat increased operating cost and fixed charges, but with materially increased illumination.

A very carefully prepared abstract of the proceedings and findings in the Colorado Springs lighting controversy, three cases before the Wisconsin Railroad Commission, and one case before the Gas and Electric Light Commission of Massachusetts are given in the appendix. The Wisconsin cases had not previously been made public, and afford some interesting and rather curious revelations. The first case was a controversy between the city of Waupaca and the local electric light company. The case was practically identical with that in the Colorado Springs controversy-viz., the city was maintaining its street lighting under a contract which

specified "2000 candle-power arc lights." The old 9.6 ampere open arcs were replaced with 6.6 series alternating inclosed arcs during the period of this contract, and the city held up the bills of the company on the ground that they were not receiving the 2000 called for in the contract. The case was exhaustively argued, with expert testimony both by engineers employed by the commission and outside engineers. The conclusion reached by the commission, however, is materially different from that reached in the Colorado Springs case. In the latter it was decided that the 7.5 ampere alternating arc was a fair equivalent of the 9.6 ampere open arcs, but that the 6.6 ampere alternating inclosed lamp fell short 20 per cent, of being an equivalent, all types of lamps being operated at their normal efficiency. The last paragraph of the findings is as follows:

It is the finding of the commission, therefore, as the result of the investigation undertaken upon this joint application, that the city of Waupaca under the circumstances has not suffered such damage by reason of the substitution of the alternating current enclosed lamps for the direct current open lamps, as to entitle it to claim any reduction from the contract price of the street lighting service furnished it by the Waupaca Electric Light & Railway Company from the time of the change in the installation of street lamps up to the present time.

One question was brought up which did not enter into the Colorado Springs case—viz., a question of equity as to whether the local lighting company was receiving more than a fair price for their service under the present system.

The second case was a similar controversy between the city of Whitewater and the local company, except that in this case the contract called for "2000 candle-power lamps using 432 watts of electrical energy." The ruling in this case was as follows:

It is, therefore, ordered that the respondent in this case, the Whitewater Electric Light Company, make such readjustments in its lamps and other equipment that it will supply and maintain 432 watts of electrical energy at each of its arc lamps during the time these lamps are in actual use and that its service in other respects be brought up to standards that are reasonable and adequate.

The third case was the city of Sheboygan, in which the city complained that the lighting company not only failed to furnish full 2000 candle-power lamps, but were not keeping the system up to reasonable efficiency. The company had substituted 7.5 ampere alternating arcs for the older pattern. The decision was as follows:

From these considerations of the facts, it appears to us that under present conditions a rate of \$68 per street arc per year would be a reasonable rate for the arc lighting involved in these proceedings, and that the respondent should immediately take such steps as may be necessary to bring the service up to a point where it can be regarded as reasonably adequate.

The equity in the cases seems to have cut a large figure. Like the backwoods innkeeper that Mark Twain told about who charged him 50 cents for a sandwich, and justified the high price by the argument that he needed the money, the decisions in these cases apparently were made more with a view to what the lighting company ought to get for its service than any stipulations which it had made in signed contracts. It is also somewhat surprising to find the commission indorsing the equivalents of a 6.6 ampere inclosed alternating arc for the old 9.6 ampere open arc, especially in view of the former decision in the Colorado Springs case.

The case of the town of Plymouth before the Massachusetts Commission was wholly a matter of equity in the price to be charged for its street lighting.

The report of the Committee on Electric Advertising and Decorative Street Lighting is brief, but contains an unusual amount of valuable suggestions and information. The principal points of information and recommendation on ornamental street lighting are as follows:

In conformity with the request of the Executive Committee we have prepared and published an illustrated book on the subject of ornamental street lighting. It is intended for distribution among the public for the purpose of arousing interest in special forms of street lighting which have esthetic and commercial functions in addition to utilitarian purposes. The publication of the book was financed by manufacturers producing ornamental street lighting material and supplies, who received proportionate quantities of the volume in exchange for their contributions.

I. The first edition consists of 10,000 copies and includes those required to supply single

copies to section members and member companies. It is suggested that general distribution be made through the central bureau of

the Commercial Section.

2. Out of 1,874 cities of 5,000 and greater population in the United States and Canada, not more than 275 now have ornamental street lighting systems, according to the best information which your committee can obtain. This number is at the same time proof of the demand for and wisdom of illumination of this nature, and of the opportunities still existing for similar installations in the large number of cities not so equipped at present.

3. It is the belief of your committee that it can do no more valuable work than to place at the disposal of member companies an informative volume to quicken public desire for street lightning of a truly ornamental and artistic character. This it has en-

deavored to accomplish.

4. We call attention to the neglected subject of the proper and artistic illumination of public buildings, squares, approaches, plazas, etc. We believe that a very considerable field for effective development here

awaits attention.

5. While all concerned have been well pleased with the general results of modern ornamental street lighting installations—viz., curb posts symmetrically arranged, bearing from one to five lamps, we regret to say that there have been several cases of failure and dissatisfaction. The latter are attributable to the following causes:

. I.—Division of responsibility for pay-

ment of operation and maintenance.

2.—Lack of engineering skill and commercial foresight in designing installations.

3.—Burdensome expense in proportion to the size and wealth of the com-

munity and taxes paid.

6. We recommend that wherever possible the central station company install and retain ownership of the ornamental lighting system, contracting with the municipal authorities for an extended period on definite terms. Street lighting of any kind is essentially a public function and should be borne at public expense. The added mercantile value to a given street will find its expression in increased property values, higher taxes and higher rents. Those chiefly benefited financially will bear their full share of cost. Installation by any other interest than the central station is or may become a logical step toward municipal ownership of all lighting facilities.

7. The design of an ornamental lighting system is not always controlled by the central station, but the latter should stop short of urging the expenditure of annual sums for operation which may become a source of irritation and criticism after the illumination has grown familiar. The efficient system for any city is one which is clearly an asset

and never an onerous liability.

8. Your committee protests emphatically against the theory that ornamental street

lighting as now generally practised militates against electric sign, window lighting, building outlining and other forms of expense-earning electric advertising. We hold that ornamental street lighting in business districts greatly increases the profitable and harmless use of the street after night fall, and thus contributes materially—sometimes vitally—to the earning power of the various mediums of electric advertising. We are satisfied that conditions as they exist support our contention.

9. We find that ornamental street lighting systems are potent in causing better paving, better street cleaning and the general improvement of streets, curbs, sidewalks and

abutting buildings.

10. With the rapidly increasing number of "white way" installations, their advertising value to a municipality, heretofore considerable in a general way, will be derived principally from the following:

I.—The attraction of shopping and amusement visitors from tributary

towns and territory.

2.—The favorable impression of the city given to the visiting stranger and to passengers on trains.

Both of these objects are valuable and important and worth paying for liberally by the

entire community benefited.

II. From an ethical point ornamental street lighting systems are of value because they decrease the possibilities for successful commission of crime, and so transform the thoroughfare after dark that loafing and hoodlumism are impossible and the acts of the recklessly disposed of both sexes, of whatever age, are literally lighted out of evil into harmless gayety and amusement. The thoroughly lighted street cannot be made the theater of wrongdoing.

the theater of wrongdoing.

15. The term "decorative street lighting" is a misnomer; the term "ornamental street lighting" is preferable. The former should be used to designate installations of a temporary nature; the latter to indicate perma-

nent installations.

16. We find that the recognized manufacturers of ornamental street lighting posts, brackets, fixtures, glassware and lamps have kept in advance of the demands of the times and are entitled to the gratitude and hearty support of the central station industry. Their progressiveness should be rewarded by the premium of our co-operation toward standardization, the protection of designs which they have originated at great expense or any other worthy movement which they may undertake.

The data and suggestions on electrical advertising are as follows:

I. The rapid advance in electric advertising within the past few years and the present scope of this work has created conditions which your committee believes are deserving of the most careful consideration. There are at present installed in the United States and Canada approximately 80,000 electric signs,

containing about 8,000,000 electric lamps. With a view to stimulating interest in questions of vital importance concerning the development and regulation of electric advertising, we beg to offer the following sugges-

2. The responsibility of the central station for esthetic results, the satisfaction of the advertiser and the increase in display lighting are incontrovertible. Any lack of interest, or unwillingness to assume a proper part of this burden, permits unregulated development and invites restrictions which react and retard legitimate growth.
3. The installation of unsightly displays

or poor mechanical effects creates unfavorable comment and criticism, which eventually leads to unreasonable restrictions.

4. Care and intelligent judgment should be exercised in the selection and recommendation of displays to the advertisers. most pertinent satisfactory type, design, size, color combination, flasher effects, etc., should be selected and advocated. In this manner a result mutually beneficial to advertiser, company and city will be accomplished. At the same time the industry will be protected against unreasonable sign ordinances.

5. All installations should be made with a view to anticipating future municipal requirements by furnishing displays of a high standard, good appearance and proper illumination, thus offsetting unfavorable de-

velopments.

6. Central stations, sign manufacturers and affiliated interests should for their common good foster and encourage the investigation and compilation of data on electrical advertising. Your committee believes that within a few years the present designs and cruder installations will be replaced by more distinctive and artistic creations, and any data on present displays will prove invaluable.

7. One of the most important features of electrical advertising is the value of motion. We believe that the increased efficiency and attractiveness of animated designs greatly exceed the difficulty and expense of caring for the necessary mechanical equipment.

8. No other form of outdoor advertising is at present so free from criticism and antagonism from esthetic reform organizations as electric advertising. On civic grounds electric advertising is generally recognized as highly desirable. It is the one advertising medium which at the same time serves a distinct commercial service and renders a distinct public service in lighting the thoroughfare. The merchant and manufacturer -in fact all who offer commodities or service through this form of advertising-may erect displays indicating their presence, title, wares and functions and while deriving profit therefrom perform an act of appreciated public value.

9. All electric signs in so far as possible should be beautiful both day and night. Too frequently the daylight aspects are overlooked. As the average use of a display is eighteen hours per day, two-thirds of which is daylight and one-third artificial light, it is

essential that a proper design and combina-

tion of pleasing colors be adopted.

10. We believe that electric advertising in original creations embodying novel mechanical motion effects is the only medium of publicity which is read and reread without tiring the reader.

The central station derives a direct benefit, second only to that of the advertiser, in electrical advertising. In order to further this development central stations should be pioneers in this respect, showing proper evidence of their own faith in its merits by installing a display or displays of sufficient proportions and novelty to establish the highest standard in the community. It is not consistent to solicit actively this class of business while the principal electrical interest of the city is lacking in evidence of its own confidence.

12. Where city ordinances are pending regulating electric advertising, the central station should urge the city authorities in every instance not only to enact liberal ordinances, but to make special provision for elaborate and extensive electrical effects for temporary service in connection with public celebrations, thus avoiding the need of circumventing an ordinance to meet public de-

mands under unusual conditions.

13. Our replies regarding the performance of Mazda and tungsten lamps have been few, and central stations as a whole have not had them in service long enough to compile the desired data. We have every reason to believe, however, that these lamps are very efficient and satisfactory. No adverse reports

have been received.

14. We find that the question of manufacturing interchangeable electric displays, to be shipped in knock-down form and installed on permanent angle-iron roof frames, is receiving much consideration, but has not sufficiently advanced to enable the committee to make an intelligent report, which should in-clude the various local regulations that would affect development of this kind.

An appendix contains classified data on ornamental lighting systems in fifty different cities in the United States and Canada, and a number of letters from commercial associations.

The Report of the Lamp Committee contains little new information, for the very good reason that there has been little actually new in the development of the incandescent lamp during the past year. The following table of sales of the different types of incandescent lamps for the past five years is interesting:

	1907.	1908.	1909.	1910.	1911
Type.	Per ct.	Per ct.			
Carbon	93.27	84.12	68.98	63.08	-52.90
Gem	5.88	8.58	15.07	14.88	19,00
Tantalum	0.75	1.78	2.12	3.57	2.74
Tungsten	0.10	5.52	13.83	18.47	25,86

Total....100.00 100.00 100.00 100.00 100.00

CURRENT LITERATURE

New Book

Modern Illumination, Theory, and Practice, by Henry C. Horstmann and Victor H. Tousley. 265 pp. Size, 4½ x 6. Illustrated. Flexible Leather, Round Corners. Frederick J. Drake & Co., Chicago. Price, \$2.00 net.

This is a small handbook dealing with the general principles of illumination and the applications of electric light. A detailed review will be given later.

American Items

Electrical World:

Sign Lighting in Seattle, Wash.; June 1.

STREET LIGHTING COSTS WITH PRESENT SYSTEMS; June 1.

SENSITIVENESS OF CAREON LAMPS TO STATIC CHARGES; June 1.

ILLUMINATION FOR KNIGHTS TEMPLARS IN PITTSBURGH; June 8.

A New Form of Candles-Per-Watt Meter for Incandescent Electric Lamps, by Herbert E. Ives; June 8.

ULTRA-VIOLET RADIATION FROM ORDINARY
ILLUMINANTS, by M. Luckiesh; June 15.

BUILDING A COMPLETE STREET LIGHTING SYSTEM FOR A CITY OF 30,000 IN NINETY DAYS; June 22.

Electrical Review and Western Electrician:

GENERAL ASPECTS OF INDUSTRIAL LIGHTING, by Louis B. Marks; June 1.

THE ILLUMINATION OF A HOME, by F. A. Vaughn; June 1.

ELECTRIC LIGHTING IN THE ARGENTINE REPUBLIC AND BRAZIL, by J. W. Tabb; June 1.

An Analysis of Glare from Paper, by M. Luckiesh; June 1.

ILLUMINATION OF A MASONIC HALL, by G. T. Hadley; June 15.

Electric Journal:

THE INSTALLATION OF INDUSTRIAL LIGHT-ING SYSTEMS, by C. E. Clewell; June. METHODS FOR CALCULATING ILLUMINATION, by E. B. Rowe; June.

Series Tungsten Lamps for Street Lighting, by H. A. Hussey; June.

Street Lighting by Metallic Flame Arc Lamps, by W. P. Hurley and C. B. Padon; June.

THE LONG BURNING FLAME CARBON ARC LAMP, by C. E. Stephens; June.

DEVELOPMENT IN THE TUNGSTEN LAMP, by Dr. C. P. Scholl; June.

THE LIGHTING OF A SMALL JEWELRY STORE by C. M. Smith; June.

SIMPLE METHODS OF GOOD LIGHTING, by W. A. Durgin; Electric City, June.

THE LIGHTING OF THE PULLMAN SHOPS, by Daniel Woodhead; Railway Electrical Engineer, June.

A New Type of Round-House Lighting; Railway Electrical Engineer, June.

GAS ARC LIGHTING; Progressive Age, June 15.

LIGHTING A BROOKLYN CHURCH; Progressive Age, June 15.

THE PRINCIPLES OF INDUSTRIAL LIGHTING, by Robert Thurston Kent; *Industrial Engineering*, June.

INCANDESCENT ELECTRIC LAMPS, by Glenn P. Cawan; The Wisconsin Engineer, May.

RADIANT EFFICIENCY OF INCANDESCENT FILA-MENTS, by W. E. Forsythe; Physical Review, May.

Problems Incident to Efficient Illumination, by C. B. Auel; Woodcraft, June.

THE BATTLE TO RELIEVE EYE-STRAIN, by John Corbin; Metropolitan, May.

New Haven's Great White Way; Dry Goods Reporter, June 15.

Editorials

Electrical World:

A Study of Ultra-Violet Radiations; June 15.

THE STREET LIGHTING SITUATION; June 22.

OPERATING LAMPS AT THE BEST VOLTAGE;

Electrical Review and Western Electrician,

June 22.

ILLUMINATING ENGINEERING AND THE CENTRAL STATION; Electric Journal, June.

New Type of Round-House Lighting; Railway Electrical Engineer, June.

IN THE PATH OF PROGRESS

A New Illuminated Draughting Table

Under the trade name of the "Ulrich Draughting Table," the Shadowless Wausau Fixture & Furniture Company of Wausau, Wis., have devised a draughting table which, it is claimed, provides an ideal form of lighting for draughtsmen. It is illuminated by electric lamps placed within, and eliminates shadows whether from neighboring artificial lamps or from natural illumination, thus tending to avoid mistakes. It is adaptable to use with any kind or thickness of paper, and is recommended highly for blueprint tracing. A booklet can be secured on this upon application.



THE NEW "ULRICH SHADOWLESS DRAUGHTING TABLE."

New Publications

In an artistically and at the same time business-like method, the Macbeth-Evans Glass Company, Pittsburgh, Pa., has just put forth its "Catalogue No. 42."

Whatever the word "catalogue" may

or may not mean to the average reader, this latest information from the Macbeth-Evans Glass Company seems too fine and comprehensive to be entitled by such a purely commercial word. This booklet is most attractively gotten up, showing a large number of shades, reflectors, dishes, spheres, and unique effects in portables and chandeliers properly presented and accompanied by sufficient information.

To show, for instance, some of their Iridile, Agalite, and Cuirass illuminating glassware, beautiful pages in color are interspersed among the regular pages. The illustrations include the newest designs in Alba, presenting pieces that might be classified as of the "acorn" motive, cut glass, Colonial and Mission leaded, and duplex etched.

With such an array of glassware, combined with its excellent illuminating engineering department, this company continues to assume an aggressive position in the field of better lighting.

Described as "Lamp Posts and Brackets De Luxe," the Smyser-Royer Company, of York and Philadelphia, Pa., has presented a most elaborate array of illustrations of lighting standards, etc., in a booklet under the above title. The booklet shows a large and comprehensive assortment of ornamental work, including uprights, brackets, and lanterns. In it there are shown 110 designs in such manner as to make a strong and clear appeal to the architect, fixture dealer, builder, or own-

Under the title, "Modern Industrial Lighting," the National Electric Light Association, Commercial Section, has produced a booklet of value to any one concerned with this kind of lighting—and who, indeed, is not?

The booklet is well illustrated and clear. The principal methods, it explains, commonly employed in lighting a work-room are as follows: Localized Lighting;

General Illumination; Combined General and Localized Lighting; Localized General Illumination. Thereupon these subjects, following general arguments in favor of good lighting, are taken up in detail under the above classifications.

Indicating the attitude of the editors in the matter, the booklet presents, as a fore-

word, the following:

"The development of the country as a whole and of the central station industry in particular, is largely based on progress

in manufacturing facilities.

"Central stations have had a large share in co-operating with municipal authorities, chambers of commerce and boards of trade in the establishment of factories, and have assisted the managements of industrial plants in the introduction and correct use of power equipment. Just as a suitable motor drive is necessary to efficient machine work, so is good lighting necessary to the efficient employment of labor."

The Committee on Industrial Lighting consists of E. H. Beil, chairman; C. E. Robertson, G. H. Stickney, B. F. Fisher, Jr., Frank B. Rae, Jr., secretary.

Personal

Albert Jackson Marshall has resigned from the Nelite Works of the General Electric Company, and announces his association with F. Laurent Godinez as consulting illuminating engineers. The firm will be known as Godinez & Marshall, and will have headquarters at 123 Duncan Avenue, Jersey City, N. J.

Mr. S. G. Meek has been appointed assistant general manager of the electrical department of the H. W. Johns-Manville Company, New York. Meek has been associated with the company as special representative in the electrical department for a period of over fifteen years, and has the honor of being one of the company's most successful salesmen. Mr. Meek's large acquaintance in the electrical industry will unquestionably be pleased to hear of his recent promotion, and he will be glad to have his friends call at the new 12-story office building now occupied by the company at Madison Avenue and Forty-first Street, New York, where he will have his headquarters.

Mr. C. E. Clewell, who has for some time been associated with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in the capacity of an illuminating engineer, has resigned to take a position in the department of electrical engineering in the Sheffield Scientific School of Yale Univer-Mr. Clewell, for the past three years, has been in charge of the department for the designing of installations for the company, until recently when he made a specialty of illuminating engineering for the detail and supply department. In this latter capacity he carried on considerable research work, also having had charge of the instruction section of the Westinghouse Club on the particular subject of illuminating engineering. Mr. Clewell is known as a careful and interesting writ-He has prepared papers relating to illuminating engineering for a number of the technical organizations interested in this subject, including the Illuminating Engineering Society and American Institute of Electrical Engineers. He was a member of the Board of Managers and of various committees of the Pittsburgh section of the Illuminating Engineering Society.

The work of collegiate instruction is no new thing to Mr. Clewell as, previous to his engagement with the Westinghouse companies, he was an instructor at Lehigh University in electrical engineering. Mr. Clewell will be associated with Dr. Charles F. Scott, who is now the professor of electrical engineering in the Sheffield Scientific School. Mr. Clewell is favored with an engaging, likable personality, which has won him many friends in the past, and which will doubtless also in his future work in instruction at Yale.

Mr. A. C. Dunham, whose retirement as president of the Hartford, Conn., Electric Light Company, was recently noted in our pages as marking a loss of the central station field, has presented to Yale University \$75,000, which will be applied to the construction of a laboratory of electrical engineering in connection with the Sheffield Scientific School. Mr. Dunham is a Yale '54 graduate. He has made this gift as a memorial to President Noah Porter and Professor James Hadley, the father of President Hadley.

GOOD LIGHTING

AND THE ILLUMINATING ENGINEER

E. S. STRUNK, Managing Editor.

H. RIDDELL, Advertising Manager.

Vol. VII

JULY, 1912

No. 5

The Lighting of an Office Building

A New and Novel Solution of the Problem

By WM. S. KILMER.

There are office buildings and office buildings—and most decidedly is it true that there is office building lighting—and office building lighting.

To a greater or less extent the ordinary

commercial line of lighting fixtures has been used with such satisfaction as might be expected of the non-discriminating. However, here is an instance where the illuminating engineer was allowed full

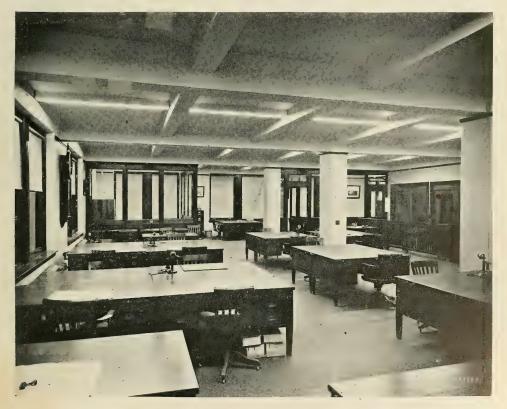


FIG. I.—TYPICAL FLOOR, SHOWING ARRANGEMENT OF FURNITURE AND EFFECT OF THE TILLUMINATION.

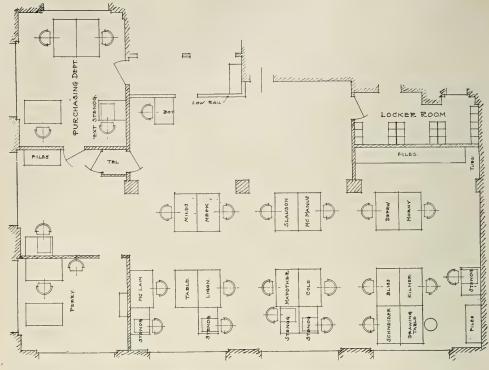


FIG. 2.—TYPICAL FLOOR PLAN (SEVENTH FLOOR).

play in producing results to meet special conditions where it had been previously decided that no localized illumination would be required during working hours for any single limited portion of the various floors. Of course, the problem centered upon producing sufficiently strong general illumination to accommodate all working surfaces.

On ten of the twelve floors comprising the installation the character of the work was identical—for clerical and office routine. Fig. 1 illustrates the conditions with which the illuminating engineer was confronted, while Fig. 2 gives the floor plan. The photograph from which the illustration was made, it might be said, was a time exposure of the equipment by night, and it can be further said that the arrangement and harmony of the system is faithfully shown by this photograph.

The remaining two floors of this building required an entirely different treatment. The main floor in Fig. 3 is used for a display room and retail department of the organization. Although the entire building is of Gothic architecture, this floor and the floor occupied by the executive offices, Figs. 4 and 5, show how, on a more elaborate scale, the dignified and beautiful effects of this period may be applied to a commercial building, and it is pleasing to note the improvement and forward step of advance a building of this character will have upon the new commercial midtown section of New York City, and cannot help but have a partial tendency to check the erection and equipment of many architectural monstrosities now housing commercial organizations.

The ceiling in all of the 10 floors above referred to measures 12 ft. in height, and is divided into squares or bays formed by the arrangement of the beam construction. On a center line of each bay running directly across the building is installed a 6-ft. section of inclosed Frink "trough" reflector. This is shown in full size detail in Fig. 6. The light source used in this fixture and in all units described in this article is the 25-watt Linolite tungsten lamp. Six lamps joined end to end con-



FIG. 3.—DISPLAY ROOM (FIRST FLOOR).



FIG. 4.—A CORRIDOR.



FIG. 5.—THE DIRECTORS' ROOM, AND PRIVATE OFFICE OF THE PRESIDENT IN THE BACKGROUND.

tinuously in each fixture comprise the unit in each bay. The reflecting surface is composed of a series of strips of rippled glass, with a mirror backing, over which is placed a coating of baked enamel, rendering the depreciation of the reflecting surface equal to the useful life of the entire installation. Owing to the flexibility of the method of arranging these mirrors, it is possible to obtain the exact distribution of light required for the particular requirements of the installation. This is a feature which is seldom possible without a prohibitive expense with moulded reflectors. To reduce the intrinsic brilliancy of the light source and to a certain extent tone the color, prismatic alluminal alabaster glass was used at the bottom, and formed the door necessary for easy access to the fixture for lamp renewals. The exterior housing of this fixture was finished in baked white enamel with nickeled door trimmings. The fixture is installed and adjusted by means of lock nuts on the nipple extending from the outlet box through to the interior of the wiring trough.

The results of an illumination test show practically an exact check on the predetermined standard. The section through the area where the test was made is shown in Fig. 7, the plane being on a

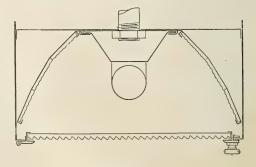


FIG. 6.—DIAGRAM, SHOWING ARRANGEMENT OF TYPICAL CEILING UNIT.

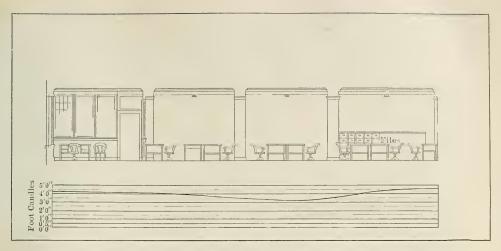


FIG. 7.—A CROSS SECTION OF FLOOR, SHOWING EFFECTIVE ILLUMINATION ON A PLANE ON A LEVEL WITH THE DESKS.

level with and on the desks. The values obtained from this test are shown in the foot-candle curve which is in direct relation to this section. It will be noted that the average illumination is 3.5 foot-candles, with a maximum of 4.5 and a minimum of 3.3. The building up of this illumination at either end is due to the high coefficient of reflection from the side walls. Applying these results to this area for a concrete summary, an efficiency in effective lumens per watt of 2.7 is found. When essential, variations in this distribution and intensity can be obtained from the method of control. At each of the posts in the center of the area is a threegang arrangement of switches, lighting opposite sides or center. As two of the sides of the building are open to daylight, on dark days it is only necessary to light the rear portion of those nearest the inclosed side.

In case only one or two persons are required to work at night, floor plugs are provided for portables, if the ceiling units are not used.

A decorative ceiling is shown on the ground floor, which, of course, required partial illumination. This was obtained from a "semi-indirect" octagon unit supported on each of the three columns. The general principle of interior construction is the same as Fig. 6, aside from the change of angles and double arrangement of reflecting surfaces necessary for both the downward and upward reflection of light. The illumination from these units is also assisted from the Gothic lanterns installed on the side walls of this area. The surfaces here do not require an intensity greater than 2 foot-candles, which is obtained, and is also very harmonious with the general scheme. In the executive quarters an average illumination of 2 footcandles is also maintained. The directors' room and private office of the president are shown in Fig. 5. The corridor of this floor is shown in Fig. 4.



Another Aid in Illumination Calculations

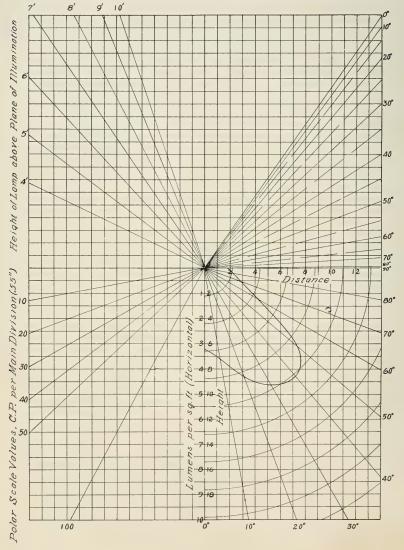
By R. F. PIERCE.

The usual procedure for "Point-by-Point" calculations is exceedingly tedious and entails an amount of time and labor entirely disproportionate to the benefits derived. The writer has used the device described below for economizing the labor of such calculations and believes that it

may be made to serve many useful purposes for the practical engineer.

The only essential feature is that all distribution curves be furnished upon sheets of substantially the same size with the same division spacings.

A sheet of transparent celluloid is ruled



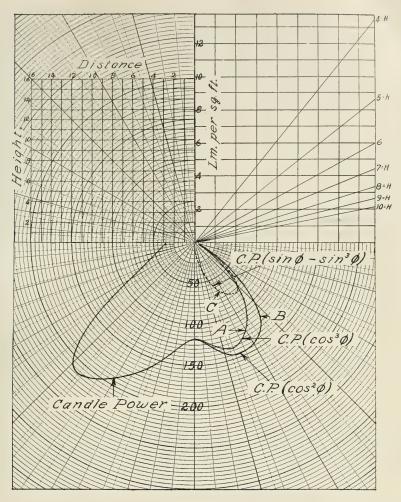


FIG. 2.

as shown in Fig. 1, but without the distribution curve, which is shown for convenience only, as it appears through the celluloid. The lower right-hand quadrant of the sheet is placed over the distribution curve with the points of origin superimposed. For the sake of clearness, few lines giving rather rough divisions have been used. Any desired degree of accuracy may be obtained (within practical limits) by increasing the number of reference lines.

Locating the angle from the intersection of the horizontal and vertical lines representing heights and distances, respectively, run along the radial line representing the angle, to the distribution curve. Thence proceed in a counter clockwise direction along the circular line representing candlepower, to the horizontal line through the origin. From this point run upward in the upper right-hand quadrant to the diagonal designated by the angle found below, thence to the left to the diagonal in the upper left-hand quadrant designated by the height, thence downward to the diagonal in the lower left-hand quadrant designated by the polar scale values used in the distribution curve, thence to the right, reading the lumens per square foot on the vertical scale.

This procedure obviates the necessity of locating the angle from a separate table, and likewise the illumination constant, and will permit of sufficient accu-

racy for all practical purposes.

The chart, as shown, is constructed for obtaining the horizontal component only, though the diagonals in the upper right-hand quadrant may be constructed to give either vertical component or normal illumination.

In case the latter are apt to be required frequently, the curves shown in the lower half of Fig. 2 may be constructed and the transparent celluloid ruled as shown in the upper half. The points in the curves shown in the lower right-hand quadrant are obtained by multiplying the candle-powers from the distribution curve by $\cos^3\phi$, $\cos^2\phi$ and $\sin\phi$ — $\sin^3\phi$, respectively, for horizontal, normal, and vertical

illumination. The chart for locating angles may be in either the upper left-hand or lower right-hand quadrants. The procedure is similar to that described above, the radial line designating the angle being first located, then the corresponding point on the proper curve in the lower right-hand quadrant. The slopes of the diagonals in the upper right-hand quadrant are proportional to the reciprocals of the heights squared, and the lumens per square foot are found on the vertical scale above the origin.

For certain purposes where various components from the same curves are frequently required such a chart will amply repay the amount of time spent in its construction.

"The Safe and Sane Fourth of July"

How New York City Celebrated the Recent National Holiday

By E. A. NORMAN.

It is undoubtedly true, and furthermore recognized, that no Fourth of July celebration in the history of New York City ever proved such a success as the last. And by success one can take into consideration the various parades, music,



Courtesy of The N. Y. Edison Co.



Courtesy of The N. Y. Edison Co.

FIG. 2.—CITY HALL SQUARE, NEW YORK CITY, SHOWING SFECIAL INDEPENDENCE DAY
ILLUMINATION.

speech-making, etc. However, the real significance of this particular celebration lies in the universal appreciation shown in the electrical displays in various public parks, squares, and other open places.

All of this was, first of all, an historic move along the lines of the "safe and sane" movement. Furthermore, the electrical displays were appreciated for their remarkable beauty and the convincing illustration which they offered of the latest and most widespread use of electric lighting for celebration purposes. As a matter of fact, the displays surpassed by far those of the Hudson-Fulton celebration.

As night fell no less than fifteen parks located in different parts of the city burst suddenly into a blaze of light. The illumination, bright and stimulating, was made more beautiful by the effects of colored lamps and Japanese lanterns. Here

and there the illumination could be seen amidst the foliage or in graceful festoons on pergolas and other buildings.

The peculiar charm of the illuminations lay in the wide variety of designs employed. In several instances the lights were strewn so thickly overhead that the street appeared to be arched with a canopy of many glistening hues. On Riverside Drive the long lines of trees bordering the way were hung with thousands of lanterns partially concealed among the branches. In other districts advantage was taken of the imposing outlines of buildings on which ropes of lights were festooned in great numbers, the loops frequently being carried across the intervening spaces. In fact, such a transformation was wrought, particularly in the parks, that these familiar areas became veritable fairy-lands, while the celebrated Drive appeared, especially for the children, as a

"wonderway" between its lofty hedges

of flickering lanterns.

The scene of the principal celebration was City Hall Park. On the three evenings of the illumination, July 3, 4 and 5, the old City Hall, conceded one of the finest specimens of Colonial architecture in the country, was lighted with many hundreds of incandescents, and the trees in the neighborhood were gay with quantities of glowing ornaments. In front of the building were erected two large stands roofed over with Venetian canopies under one of which was stationed a band to lead the huge public choruses with which the programme was interspersed. Dr. Frank Rix, who conducted the singing, made use of an electric baton tipped with a flaming bulb.

Of the great crowds that assembled to watch the illuminations, one of the largest was at Columbus Park, where electrically lighted Japanese lanterns were strung through the trees. The lights in Chelsea and De Witt Clinton parks together numbered something over 12,000, and were appreciated by the children, as only

children can, for whom these particular illuminations were intended. The scene in front of the Settlement House on Henry Street afforded the most unique spectacle of the entire celebration. Here a public-spirited gentleman had seen to it that arches of lights were erected over the street at short intervals, and the management had arranged a programme of folk dancing for which the locality, Russian in nationality, is well known. It is unnecessary to mention the keen interest with which the dancing was watched not only from the crowded sidewalks, but from every window in the quarter, as the couples passed back and forth beneath the arches.

Any one familiar with New York will see how these electrical celebrations in various sections of the city have a peculiar significance. As a matter of fact, New York City is a group of communities which are almost cities by themselves, even if one may touch another. They are as isolated, almost, as if immured; in each of these several sections there are thousands of people who seldom depart from



Courtesy of The N. Y. Edison Co.

FIG. 3 .- MOUNT MORRIS PARK, NEW YORK CITY.



Courtesy of The N. Y. Edison Co.

FIG. 4.—BRONX BOROUGH HALL, NEW YORK CITY.

the sectional lines of their respective stamping-grounds. Such electrical celebrations, accordingly, become virtually what you would call neighborhood aftairs; whereas in other cities not so large the localized celebrations would not count for so much as in New York.

In addition to the streets and parks already mentioned equally attractive illuminations were to be seen at Forty-ninth Street east of First Avenue, Abingdon Square, Hamilton Fish Park, Carl Schurz, Jefferson and Mount Morris parks, Mount Morris Park west from 120th to 124th Street, McKinley and Rutgers squares, and Recreation Park between 101st and 102d streets. The survival of the old Fourth of July idea, however, was noted in but very few instances, and altogether a surprisingly small number of accidents took place during the day. The celebration may well be said to have been a modern, civilized "July Fourth."

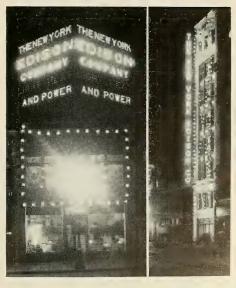


FIG. 5.—TWO DISTRICT OFFICES OF THE N. Y. EDISON CO. IN FOURTH OF JULY ATTIRE.

Accurate Timing in Sign Flashing

By I. H. VAN HORN

The design of a rapidly flashing sign, in which very delicate effects are sought, requires some knowledge of the length of time, after the electric circuit is closed, before the sign lamps come up to full brilliancy.

It is a matter of common knowledge that the carbon lamp does not come up to brilliancy as quickly as the Mazda lamp, the reason assigned being the difference in the resistance and radiating characteristics of the filaments. The time required for either lamp, put on a constant voltage circuit, to reach its normal candle-power is of the order of magnitude of a few tenths of a second.

That accurate measurements of this magnitude are difficult to make can readily be appreciated. The method of arriving at the results in the table is briefly described below. By means of an oscillograph, photographic records of the current rise, with time, were taken for each lamp. Since the lamps were placed on constant-voltage circuits, the current curves afford a means of getting the resistance-time curves of the lamps. The resistance in a given lamp filament being

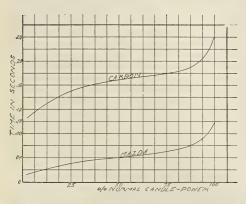


FIG. I.—CANDLE-POWER-TIME CURVES DURING LIGHTING OF MAZDA AND CARBON LAMPS.

a function of the filament, temperature is also a function of the candle-power of the lamp. The resistance-candle-power function has been carefully determined for both the carbon and tungsten filaments. The resistance-time curves then furnish data from which the desired candle-power-time curves can be computed.

The following table gives comparative data on the carbon and Mazda sign lamps operated at their normal efficiencies:

Per cent. normal	_Time in seconds
candle-power.	Mazda, Carbon.
0,	
25,	. 0.03 0.15
50	. 0.04 - 0.17
75	. 0.05 0.18
87,.,,,	. 0.06 0.19
1.00	

From this table it is evident that the time required by the Mazda to come up to candle-power is almost negligible. In case both carbon and Mazda lamps are to be used in the same sign the time factor comes in.

Where accurate timing of a sign is essential, the resistance of the circuit external to the lamps must also be considered. The effect of an external resistance is to cut down the initial voltage impressed on the lamp and thus to slow down the candle-power rise.

Some rough observations seem also to indicate that the candle-power-time curve is governed largely by the final temperature or efficiency at which the lamp operates; the higher the operating temperature the quicker the lamp will rise to candle-power.

The results in the table, while fairly representative, must not be taken as absolute. They represent the best information at hand. To insure the success of a complicated design the designer must be thoroughly familiar with all the variables which may affect its operation.

Street Lighting at Terre Haute

Building Fronts Successfully Illuminated and Trolley Poles Made Ornamental

A successful attempt at street lighting has been secured at Terre Haute, Ind., by enlisting the services of the trolley poles as supports for brackets. The particular section which has been lighted so far lies between Fifth and Sixth streets on Wabash avenue. The lamp used was the Westinghouse four-ampere series metallic arc lamps. They are supported from brackets which stand out from the trolley pole, and have been adjusted so as to produce the "White Way" effect, as well as giving the building fronts ample illumination.

This illumination is more than ordinarily uniform from top to bottom; while, furthermore, the brackets and lamps combine during the day to make the street more attractive and take some of the bare effect from the trolley pole—by day as well as by night. A further advantage obtained from this installation is the fact that no extra poles were necessary. The installation has been welcomed by the merchants and citizens generally. Wabash avenue, along which these new lamps have been placed, was formerly far from being the lively business section which would be expected at night of a lively, bustling community like Terre Haute.

The installation was brought about by the activities of T. F. Grover, General



FIG. I.—WABASH AVENUE, TERRE HAUTE, IND., SHOWING NEW ORNAMENTAL COMBINATION TROLLEY AND LAMP-POSTS.



FIG. 2.—NIGHT VIEW, SHOWING THE EFFECT OF THE ILLUMINATION WITH METALLIC FLAME ARCS.

Manager of Terre Haute, Indianapolis, and Eastern Traction Company. He made extensive investigations of the subject for the purpose of securing just the

kind of illumination which would fit the case—ample and attractive, with such ornamental equipment as circumstances would permit.

A Center of Illuminating Interest

By S. G. HIBBEN

Standing where the camera of Fig. 1 stood, and looking south and east over the University of Pittsburgh campus, past the Allegheny County Soldiers' Memorial and the Schenley Hotel and across the entrance of Schenley Park, the native Pittsburgher or a visitor to that city may survey a district that includes within its small boundaries a larger number of remarkable lighting installations and of a larger variety, than perhaps any other similar comprehensive territory in this

country. Here, within a quarter mile circle, is found the most unique yet altogether the most surprising and pleasing installation of interior lighting, the best example of a brilliantly illuminated outdoor athletic field and hippodrome; an excellent ornamental boulevard post lighting system, and a similarly satisfactory modern arc lamp street lighting installation; together with one of the best displays of art gallery lighting, a pleasing installation of semi-indirect fixtures in a

hotel dining room, and finally two great universities where photometric and kindred investigations are being made continually.

Referring to Fig. 1, the first two buildings in the near foreground are of the University of Pittsburgh, flanked on the right by the Eighteenth Regiment Armory. In the center stands the Soldiers' Memorial, while behind and to the right can be seen the Schenley Hotel and to the right of this the Forbes Field Ball Park. Beyond the Memorial to the left stand the University Club and the Pittsburgh Athletic Association, and behind these buildings may be seen the broad and low Carnegie Institute, with the buildings of Carnegie Technical Schools in the left background.

This is Pittsburgh's great civic center. It is interesting architecturally, because of the large number of imposing structures clustered within it, and it is doubly interesting to the illuminating engineers because of these closely centered and prominent lighting installations. Whatever the desire of the person interested in more and better light, whether studies in the field, in the building or in the laboratory, he can accomplish the fulfillment of his desires through investigations made in this small district. This, then, is the justification of its mention here.

First among the examples of interior

lighting in this district is the widely known Allegheny County Soldiers' Memorial Hall. The exterior of a beautiful edifice is causative of the first strong impression made upon the observer, and usually it forms the mental picture that one retains as his recollection of the structure. So it is with the Soldiers' Memorial, for it dominates a slope overlooking a pleasing group of civic buildings, and from this imposing position, and with its majestic façade, its solidity of contour and its virile architecture, it commands attention for its very individuality.

But this first impression may not be the final and lasting one, for certain it is that with the memory of the exterior is mingled the impression of the remarkable and almost weird electrical interior illumination. This building (Fig. 2) contains an example of lighting by methods of the new school. Its most striking feature is the main auditorium (Fig. 3), 120 ft. square and 65 ft. to the ceiling, with not a single lighting fixture visible. All the light from a consumption of over 50 kw. of electricity is diffused downward through glass plates that form the false ceiling, with such softness that the intensity of 33/4 foot candles at the seats is as unobtrusive as moonlight. The wonder lies also in the riotous colors produced both by the glass and by the light-sources. There are amber tints from carbon and



FIG. I.—PITTSBURGH'S NEW CIVIC CENTER, OFFERING UNLIMITED STUDY FOR ITS EXCELLENT ILLUMINATING ENGINEERING INSTALLATIONS.



FIG. 2.—SOLDIERS' MEMORIAL, PITTSBURGH.

tungsten lamps, rose from nitrogen vapor tubes, yellow from flame arc lamps, bluegreen from mercury vapor tubes, scintillating tungsten stars, and combinations of all these that reproduce gradations from noontime brightness through sunset to starlight. Altogether the illuminating system in this building is perhaps the greatest of the great installations that form one of the features of this center of illuminating interest.

To the right and in the background of Fig. I can be seen another structure, Forbes Field Grandstand, which is one of the National League's greatest ball parks. This enclosure forms also a spacious athletic field and open-air hippodrome. It interests the illuminating fraternity because at night this field is brilliantly illuminated by beams of light from extraordinarily powerful arc searchlights. Three groups of two lamps each direct their rays downward and outward from the inside edge of the roof above the seats, and since these lamps are easily 100 ft. above the ground, their beams converge and uniformly illuminate the whole field. The size of these search-lights can be estimated from knowing that their lenses are nearly 3 ft. across.

This system is praiseworthy for its success in fulfilling unusual requirements of outdoor lighting. The units are few and far from the points to be illuminated, yet the intensity in the field is high and shadows are not noticeable. Foot races and field events are held here at night, while vaudeville performances are staged without auxiliary lighting, and as an example of the excellence of the results, rifle shooting and juggling acts can be done without the aid of other artificial illumination.

A third distinct display in this little district consists of a modern installation of boulevard lighting. Extending along two lines from the Forbes Street entrance of Schenley Park, both on the roadway and beside the main walk (Fig. 4), are ornamental posts that form another feature of this center of illuminating engineering interest. These posts are distributed across what is known as the Junction Hollow Bridge (behind the Soldiers' Memorial in Fig. 1) and branch into two lines, one leading to the left up the winding parkway to the Carnegie Technical

Schools and the other to the right past the famous Phipps Conservatory to Panther Hollow Bridge. In all there are over 100 single-light standards and some dozen five-light standards, all of rolled metal and bearing Alba glass ball globes. More than being solely an example of the most modern system of this type of lighting, this installation is of special interest since these are not tungsten but gas standards. with incandescent mantles, and a more pleasing application of gas would be hard to find. Then, furthermore, the association of surroundings adds interest to the installation, since the exterior of Pittsburgh's most famous institution—the Carnegie Museum and Library—and the entrance to Pittsburgh's most appreciated breathing space—Schenley Park—are illuminated by these ornamental units.

But the visitor to this part of Pittsburgh need not stop with a consideration of the boulevard post lighting, for a most modern type of street arc lighting is on display within a stone's throw of the ornamental gas standard installation. Several streets, notably the one leading north from the Hotel Schenley, with the Pittsburgh Athletic Association Building, the University Club and the Twentieth Century Club on one side and the Soldiers' Memorial Building and the University of Pittsburgh on the other side, are illuminated by Westinghouse metallic-flame arc lamps on ornamental poles. One such pole may be seen in Fig. 2. What a remarkable setting is this for a display of street lighting!

The automobile travel is heavy along these streets, and the arcs, though very brilliant, are fairly high, and the reflections from the rubber-polished asphalt give the light-colored background against which the vehicles are silhouetted very satisfactorily.

There are other features in this small district that interest the illuminating engineer, which may be less praiseworthy



FIG. 3 .- MAIN AUDITORIUM, SOLDIERS' MEMORIAL, PITTSBURGH.



FIG. 4.—BOULEVARD LIGHTING STANDARDS, FORBES STREET ENTRANCE TO SCHENLEY PARK, PITTSBURGH.

but nevertheless notable. These features are the lighting of the Athletic Club by diffusing reflectors and by all-frosted lamps, the picture lighting of the Carnegie Art Galleries, and the recent application of semi-indirect glass bowls in the Schenley Hotel.

Inside a circle of a small quarter of a mile radius from the Carnegie Library are two educational institutions where investigations are being made of all manner of lighting subjects. These are the University of Pittsburgh and the Carnegie Technical Schools. In the university the cause of good lighting is being indirectly advanced by the study of the prevention of smoke and investigations directed against natural darkness.

At the Technical Schools are found

excellent photometrical laboratories where studies are being made of color-transmission of glasses, light distribution and allied subjects.

Any of these installations mentioned are worthy of separate detailed description, and several of them have previously received technical mention, but the present point to be emphasized is the grouping of these installations and their close proximity. When one can stand in a spot and without changing position can see places where there are so many types of lighting, and all of them as prominent as those mentioned above, he may well consider his position unique; and thus his position will be, when he surveys this condensed center of illuminating interest from one vantage point.

"The Lamp of Midsummer"

Some Timely Suggestions for the Summer Home or Bungalow

By J. Woodley Gosling.

What has become of all those delicate and charming little white panels which were used in lamp shades, or hung, as transparencies, in windows, two or three score years ago? The designs were most intricately and finely embossed in a material which closely resembled alabaster in texture, but were really of bisque. The

effect of the design could only be seen when the light was shining through it, the surface having simply an uneven or roughened appearance. To-day these most artistic and superb results of the artisan's skill would be of the greatest value in the fabrication of lighting fixtures of the semi-direct type, and also for the building of inexpensive and effective lamps to be used in the summer home or bungalow.

It is the lamp for summer use which we really wish to consider at this moment, and we shall have to look to materials for it which are easily worked and produce a good appearance with small expense. The choice of material of which the lamp of the summer home is composed, though in-

expensive, is most varied.

Probably the cheapest materials to work with are paper and wood. They are also the least enduring, but with them results which are most beautiful and valuable from a good lighting standpoint have been obtained. Japan has produced an endless variety of these creations, and most of them are good in design and some in color. The majority are somewhat glaring in their attempts at the use of ink, but one may readily find those which embody graceful outlines, good color harmony and a pleasing touch of the appreciation of the beautiful in nature, in the subject and composition of the design, which together add a most cheerful spot in the summer living room.

From paper and bent wood we may turn to such materials as wood frames and stands with panels of woven cane, tapestry, silk, or glass, while many odd and attractive lamps are made of basket work, woven rattan, or willow, silk with

leather appliqué and cretonne.

For the more durable articles, metal must be employed, and there the freedom of selection is as great as in the more delicate creations. Lamps of wrought copper and iron, cast brass, and the softer metals which have lead as their principal ingredient, while spun or pressed brass, or brass which has a design etched out with acid, are among the many methods used in this field of endeavor to meet the fickle and changing tastes of those who must use such a necessary article of furniture as a lamp.

A most attractive and effective lamp for oil, which, by the way, in the majority of cases, is the medium used for lighting in the summer home, consists of a bowl of thin, light, Indian pottery, arranged with a font and shade holder. The shade is made of silk, dyed to harmonize in color with the simple crude tones of the bowl, and is trimmed with leather and Indian beads.

The shade of cretonne is also most practical, and lends a pleasing spot of color in the room. It may be of a pattern which is like the furniture cushions or wall coverings, and when the base of the lamp is of the same material as the furniture the result is quite harmonious.

The basket-like woven cane lamp, though not giving an abundance of light, is most pleasing and generally fits in well with the furnishings of the average summer room. The base is generally of a squat vase form and the shade of very simple lines, lined with silk or paper. This type of lamp is subject to a great variety of treatment, both as to form, color, and the material of which the basket-work is composed. They may be extremely smooth and regular in their weaving or may be made of colored grasses, having woven in the meshes beads, pieces of metal or glass.

The lamp of wood generally received a very simple treatment, but the possibilities for making both artistic and durable lamps for summer use, of wood, with shades of dyed materials, leaded glass or panels of various kinds, is unlimited. They are quite appropriate for interiors

of Mission or Flemish character.

Leaded glass, with all its possibilities of bright, cheerful and harmonious color, has here its most appropriate place. It is most difficult to reconcile it with the Classic, Italian and French styles of decoration, while our modern summer homes quite depart from these older set styles and are developing a character all their own. It is here that a product of modern American craftsmanship is most to be desired, and in the choice of this type of lamp one may select with free fancy.

Efforts to catch the eye have resulted in the making of lamps of such materials as stone-ware, pottery, terra cotta, china and compositions which are composed of plaster, paper or glue, but though most of them have good color in their glazes and finish they are of no value for good lighting, are heavy and cumbersome objects to move, being of materials which belong outside the field of the lamp maker and are of more use to the maker of vases.

tiles, and building materials. The last named materials seem to have less value as mediums of which to build table lamps than any of the others, as they are soft and fragile and should only be employed in the making of picture frames, hanging fixtures and objects which require but occasional handling.

Lighting the New Masonic Hall in the Auditorium Hotel, Chicago

By G. T. HADLEY

The new Masonic Hall in the Auditorium Hotel occupies the Egyptian room formerly used as a banquet hall, and the illumination comprised 560 56-watt carbon lamps. Ten electric light fixtures with 35 lights to a fixture, about 100

lights under the balcony and 75 above, made a great glare, but not an economic or entirely efficient illumination. This old Egyptian room is one of magnificent proportions, 85 x 40 ft., with a 22-ft. ceiling. Mr. F. A. Vath, illuminating en-



FIG. I .- THE LOBBY IN THE NEW MASONIC HALL, AUDITORIUM HOTEL, CHICAGO.



FIG. 2.—VIEW OF HALL BY INDIRECT ILLUMINATION.

gineer for the hotel company, undertook to remodel the room and make it over in 60 days, with due consideration for the efficiencies and economies of illumination as important factors of the work.

The room was already reminiscent of Egypt, with stately columns of polished birch surmounted by hand-carved capitals and between the capitals thirteen oil paintings. Each painting has been effectively illuminated by three 20-watt concealed lamps. Eighteen art glass windows presented a problem which was successfully solved by placing a direct lighting unit behind each window at the proper angle, so that the art glass patterns become distinctly visible when the other lights are dimmed. From the 21 stucco panels of the ceiling, 21 indirect lighting fixtures were suspended, each unit containing one 100-watt tungsten lamp with reflector. In the "east" end of the hall above the chair of the grand master is the

usual blazing star and the letter G equipped with one 25-watt lamp. There are no exposed lights in the hall except the altar lights mounted on a tripod beside the altar in the center of the room, and these lights have frosted globes. 21 indirect lighting units, the lamps illuminating the paintings, and all others in the room are under the control of a regular theatre dimmer. In all, a hall fitted up like a temple with all lights under perfect control, the administration of the American rites to an "entered apprentice" must be remarkably impressive and awe-inspiring. Additional auxiliaries in the way of an organ of superb tonal power, a stereopticon machine for the projection of pictures, combined with the wonderful psychological effect of the illumination are well calculated to impress the candidate during the ceremony of initiation.

In this instance, the ancient "myster-

ies" have been most skilfully supplemented by modern scientific illumination. The lighting system has been worked with a view to effects rather than watts or footcandle intensities. There are no shadows, and it is possible to read ordinary print at any point in the room, yet the illumination is so efficient, the light so soft and diffused that the effect produced is one of absolute peace and restfulness. The hall is already so popular with the lodges that it will soon be in use every

night of the week and will yield a probable rental of some \$10,000 annually.

The change throughout the hotel from the old system of lighting makes a saving of 58.22 per cent. in power consumption.

Three years ago the electric light load ran from 75,000 to 80,000 kw. monthly; now it runs from 35,000 to 42,000 kw. monthly. There is less expenditure of power than ever before, but more and better illumination.

Ornamental Lighting at a Health Resort

Mt. Clemens, Mich., Chases Away the Night Gloom Through Business Men's Co-Operation

By T. L. HANKS.

Perhaps it does not matter much if the merchants of Mt. Clemens got together and installed ornamental street lighting for their own pecuniary benefit—direct—or were broad-gauged enough to see that the good cheer and attractiveness of their business section, also indirectly must add

to their own prosperity because it would make the community as a whole prosperous and progressive.

The grand opening took place accompanied by music. The city band was there and so was the Mayor. The latter made an address along the lines of booming the



FIG. I.-MT. CLEMENS, MICH., SHOWING BEGINNING OF NEW WHITE WAY.



FIG. 3.—NEW ORNAMENTAL LIGHTING AT MT. CLEMENS, SHOWING BEGINNING OF NEW "WHITE WAY."

street, as well as all else pertaining to Mt. Clemens. Merchants, on its first night, just as the lights went on, put up their best front, extended greetings to the passers-by who had turned out in large numbers, and, furthermore, accepted the occasion as a psychological moment for giving away souvenirs.

It was a surprise, an event beyond expectations in one respect, that so many people should have invaded Mt. Clemens on this gala event from the neighboring towns and the country around about. For these visitors it was a show, indeed, in itself; and it put a lot of money into circulation.

The merchants, after due planning, signed a contract with the lighting company (Eastern Michigan Edison Company, St. Clair Division), covering a period of two years, at \$4.50 a post a month.

The posts are equipped with 5-100 watt tungsten lamps and are burned from dusk to 10 o'clock each night, except on Saturday nights, when they are left on until II o'clock. The company's night repair men take care of turning on and off, and also maintain the lamps.

The particular section which has been illuminated is not what you would call the business center. But, as would be expected, on the gala opening night there were crowded into this section more human beings than ever had been there before on any one night.

The most important feature, however, lies in the fact attested to by all the merchants that their individual businesses have shown such marked increase from this method of ornamental lighting that they are more than satisfied. They are enthusiastic. A visit to Mt. Clemens and a talk with the merchants generally will convince anyone that the activities of the lighting company are appreciated. As one instance of this, two additional blocks of the merchants' section are prepared to sign similar contracts with the company for "more of the same."



FIG. I.—NIGHT VIEW OF THE NATIONAL DEMOCRATIC CONVENTION HALL AT BALTIMORE.

Lighting a Large Convention Hall

How the Recent National Democratic Convention at Baltimore Was Lighted

By P. A. Boyd.

One of the reasons for selecting Baltimore as the place to hold the National Democratic Convention was the fact that one of the largest buildings in the country suitable for this purpose is located therenamely, the Maryland Fifth Regiment Armory.

After this selection had been made, one of the most serious problems confronting the convention committee was the proper illumination of this immense building, the floor space of which is 60,000 square feet (300 x 200), and will seat, including the temporary galleries erected, 15,166 people. The convention committee decided to install a permanent lighting system, and practically every scheme

of illumination was considered. After a most thorough demonstration, the committee was convinced that the flame carbon arc lamp was the most suitable for the purpose on account of the splendid illuminating qualities and the low operating and maintenance cost. It was, therefore, decided to install forty-nine Westinghouse multiple flame carbon arc lamps with light opalescent globes for operation on 110-volt, 60-cycle alternating current circuits.

In order to obtain a high and uniform illumination, the lamps are arranged in ten rows. In the four center rows, directly over the speaker's platform and the seats of the delegates, there are seven lamps

per row, spaced 25 feet apart. In the remaining rows there are alternately three

and four lamps.

The mounting height is 35 feet above the main floor, and 45 feet over the galleries. This height allowed the audience in all parts of the building to see the speaker's stand without having the lamps in their line of vision, and also enabled the chairman to see and readily recognize any delegate on any part of the main floor who might arise to speak.

It was immediately recognized that the illumination was a great success, and, although the total illumination was more than was absolutely necessary, the effect

was exceedingly striking.

One evening before the convention assembled, the building was thrown open to the public, and it is estimated that more than 75,000 people visited the hall, and, although it was very beautifully decorated, the illumination was commented on more than any other single feature.

The chairman of the convention committee complimented the consulting engineer, and expressed his delight at the excellence of the illumination in the most

flattering terms.

A number of prominent illuminating engineers who visited the building during the evening stated that it was by far the best illumination of its kind they had ever seen.

The Newest in Electric Signs

Another Device for Attracting and Holding the Attention of the Passing Throng

By Frank C. Reilly.

The development of things electrical has been so rapid and startling, during the past few years, that the electrical world, and the public in general, accept each new device as a matter of course, but the Bickley Motograph, a new type of electric sign which has recently been introduced in Detroit, has caused no little stir in the electrical and advertising fields.

To describe the instrument, and do it justice, is difficult. The first thing that impresses the observer is the fact that the advertising matter is in motion. Never has a display been developed that embodies

this principle, or so abruptly arrests and completely absorbs the attention of all beholders.

The second feature is the versatility. A perforated paper ribbon, similar to the rolls used on the modern piano-player, controls this display. To make a complete change in the advertising requires less than a minute. Accompanying this article are two illustrations showing a short section of the perforated ribbon and a complete roll as used in this display.

The apparatus consists of two units: a bulletin-panel studded with lamps and the



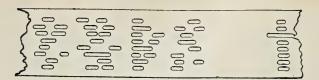


FIG. 2 .-- SHEET STRIP OF MOTOGRAPH RIBBON.

controller. The perforated ribbon running through the controller lights and extinguishes the lamps in the proper sequence, thus producing the effect of mov-

ing letters.

The effect produced, the "attention value," is so strong, in fact, that two very serious accidents have been narrowly avoided in Detroit, where the first instrument has been in operation for several weeks. One man, whose attention was suddenly arrested by it, stopped in the middle of the street, regardless of an approaching auto, and sustained a fractured rib. Two nights later, a young lady was so indiscreet as to stop at precisely the same spot; although she collided with an electric coupe, her injuries were less serious.

It is to the panoramic principle of the display that the success of this sign is expected. The reading matter is introduced onto the bulletin-panel from the extreme right (of the sign), travels the entire length of the sign and disappears at the extreme left. The sketch at the beginning of this article fairly illustrates the panoramic principle.

The Motograph is read as easily as a theater programme, although some, who have never seen the sign in operation, do not comprehend this at first. The fact that these displays are obtainable in sizes capable of producing letters up to 16 feet in height makes it applicable to the re-

quirements of any business.

One of the most remarkable things about this system is the fact that it can produce any style of letter, either block, old English, or script. Rolls that will reproduce trade-marks, figures, or special designs, can be furnished by the manufacturers on a few hours' notice. Hebrew characters can be reproduced as easily as the simplest of block letters.

Another feature is the economy of operation. An instrument producing 6-ft.

letters can be operated with an hourly current consumption of less than 5 kw. This is easily accounted for by the fact that but from 23 to 28 per cent. of the lamps are burning continuously.

The controlling mechanism is an interesting specimen of advanced electrical

construction.

When the question of lamps came up the combined laboratories of the General Electric Company and the National Electric Lamp Association gave their co-operation. The new 10-watt, 100-130 volt sign lamp is peculiarly adapted to the requirements of the device. It is a striking example of the progress that has been made in high-efficiency lamp construction and represents the most advanced ideas of the foremost physicists and engineers. A quarter-size cut of the new lamp is shown.

The field to which the device is adapted is broad. For department stores, play-houses, railroad terminals and national advertisers, it holds out possibilities. For theaters requiring a daily or weekly change of advertising this sign is useful. Department stores can run off a list of

special sales, details of deliveryservice, or exploit the convenience of their mail order department. Owing to the fact that rolls of any length, five thousand words if necessary, are obtainable, the opportunity for the advertising man is unlimited.

One special advantage is the fact that the bulletinpanel can be erected on a tower if desired, surrounding

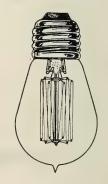


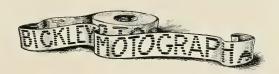
FIG. 3.—NEW 10-WATT, 100-130
VOLT MAZDA SIGN
LAMP FOR USE
WITH MOTO-GRAPH.

all sides, and still be readable from any point, as all of the advertising would make a complete circuit of the tower, thus making it readable from any point.

Wherever possible, motion has been the magnet used to attract the attention of the public. Coupled with brilliancy, motion has been responsible for the success of many electrical displays. Previously, however, inventors have failed in placing the advertising matter itself in motion. Heretofore, an accessory spectacle has been used to gain the attention of the observer, and then an attempt made to transfer his attention from the automatic part of the display to the advertising mat-

ter. This competition of elements is detrimental to the complete success of the sign as an advertising proposition. Unconsciously the mind and the eye wander back to the moving part of the display, thus failing to absorb the advertisement.

This system is also arranged for use as a newspaper bulletin. Within a comparatively short time we may see the news of the world flashed out in electric letters, readable a mile away. This surely will be a relief from the crush experienced before the old style bulletins, in front of which we have all crowded and jostled in order to ascertain how many rounds "it went."



Obituary

In the death of Arthur J. Morgan, of Chicago, the illuminating engineering fraternity loses a most earnest and persistent worker. Mr. Morgan died July 5, at the age of thirty-nine. In his commercial capacity as secretary of the National X-Ray Reflector Co., Mr. Morgan contributed materially to the progress of illumination. Mr. Morgan came to Chicago in 1900. He was born in Los Angeles. It is certainly true of Mr. Morgan that he had a kindly disposition, which, combined with his sincerity in business dealings, made him many real friends.

Besides being a member of the Illuminating Engineering Society, Mr. Morgan was an active member of the Chicago

Brass Manufacturers' Association, and the Chicago Association of Commerce. He is survived by his wife and two young children, his mother and two sisters.

Mr. Andrew E. Stevens, manager of the Consumers' Power Co., Minot, N. D., was recently killed in an automobile accident. Mr. Stevens was connected with H. M. Byllesby & Co., who operated the North Dakota lighting plant, having previously spent several years in shop and street railway work in Minneapolis and St. Paul. Mrs. Stevens narrowly escaped death, as did other ladies who were also in the car with Mr. Stevens when it overturned.

Some New Models in Indirect Lighting Fixtures

Growth in Popularity of This Method of Illumination

Indirect lighting has unquestionably won the day. At first received with skepticism or indifference, it soon aroused aggressive opposition, and the controversies that have followed have been many and occasionally shown much more feeling than is compatible with the impersonal view which science should take of all new ideas. But even this animosity served a useful purpose in attracting attention to this system of lighting. Strained attempts to prove that a new discovery or device is useless arouses in the impartial mind the suspicion that the contrary is true. Indirect lighting has been assailed from all angles-hygienic, economic and artistic-but the assailants have had to retreat from all three positions. The first



FIG. I.—A CLASSIC DESIGN.



FIG. 2.—A BABYLONIAN MOTIVE.

flag to be hauled down was from the hygienic point of attack. The preponderance of evidence both from oculists and laymen was overwhelming, so that indirect lighting is now generally considered to be the most perfect substitute for daylight, so far as the effect upon the eyes is concerned, of any method of artificial illumination. The question of economy has also been satisfactorily settled; while it is freely admitted that indirect lighting is somewhat less efficient by the usual methods of measurement than the best direct systems, the difference is far less than was at first supposed, and when visual efficiency is considered the difference may entirely disappear. But even assuming the difference of thirty or forty per cent., the



FIG. 3.—PURE GRECIAN.

visual comfort secured is well worth the cost.

From the artistic viewpoint indirect lighting was said to be shadowless, and therefore to produce a flat effect, which was objectionable. This was pure assumption, which was easily shown to be false by actual experience. As a matter of fact the artistic advantages of indirect lighting are only second to its hygienic superiority. The fixtures offer an opportunity for harmony with surroundings to a much greater extent than direct lighting fixtures. The examples shown herewith will serve to illustrate this point.

In Fig. 1 we have a bowl of classical design and decoration of a size suitable for the average parlor or drawing room. The material is a special composition

which admits of plastic decoration, and can be finished in any of the metal surfaces or to simulate old marble or ivory. Fig. 2 is a larger fixture suited to hotels and public buildings, the decoration suggesting the Babylonian. Fig. 3 is a bowl of different contour in Greek design. Fig. 4 is somewhat different treatment of the same style and decoration. These fixtures have the advantage of being light, strong and durable in finish. Any arrangement of lamps can be used to suit special requirements. Within the fixtures there is inclosed a white enamel reflector, having a high coefficient of the diffused reflection. These are only a few of the designs which have been produced by the manufacturer to show the artistic possibilities of this method of lighting.



FIG. 4.-MODERNIZED CLASSIC.

Hospital Lighting

By WILLIAM S. KILMER.

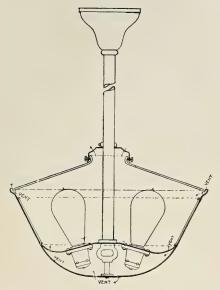


FIG. I.—TYPICAL DUST PROOF UNIT USED FOR WARD LIGHTING, POST-GRADUATE HOSPITAL, NEW YORK.

II.—WARD LIGHTING.

For the general lighting of a hospital

ward the chief considerations are a soft, evenly diffused light and a minimum amount of heat generated. The first is undoubtedly the most important, as the influence of glare upon the retina of the debilitated or depressed is usually followed by serious results. The question of color also plays an important part, and it has been the source of a great deal of discussion. The average condition, however, is satisfactorily met by the tungsten lamp with the color corrections from a tinted ceiling, or translucent media. As to the quantity of illumination for a ward without localized lighting, an average illumination of 2 foot-candles should be maintained. For wards with localized lighting facilities this can easily be reduced to from .5 to I foot-candle. Of course, conditions arise necessitating variations in these intensities.

It is very difficult to recommend any stock form of lighting fixtures for this class of work, but to meet the requirements as near as possible it is obvious that an indirect system is preferable.

The ordinary line of fixtures for indirect lighting usually produce bad results in a hospital ward, as each separate ward demands a specially constructed unit, as the success of any indirect scheme depends largely on the accuracy of the angles of reflection, and what is suitable for a narrow, low room would not produce satisfactory results in a high and wide room; also the nature of the diseases of the pa-



FIG. 2.—NIGHT VIEW OF THE WARDS OF THE POST-GRADUATE HOSPITAL, NEW YORK.

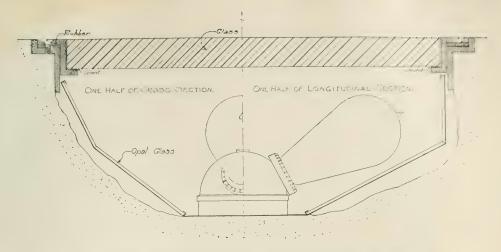


FIG. 3.—DIAGRAM SHOWING CONSTRUCTION OF ONE OF THE FLOOR UNITS USED FOR WARD ILLUMINATION, GERMAN HOSPITAL, NEW YORK.

tients occupying the wards has to be considered. To give the contrast necessary to rest the retina of the eye from an evenly illuminated ceiling, it is advisable to tint the side walls in a contrast to the ceiling.

Simplicity of design and construction should be followed for the fixtures. This keeps the accumulation of dust and germs to a minimum. Another good recommendation is that a thin blown glass plate be placed on the top of the fixture, thus keeping dust from accumulating inside, and also offers an opportunity to tint the light to make color corrections. To illustrate a fixture of this character, Fig. 1 shows the points considered in detail, while Fig. 2 shows an actual installation of the units in a typical ward of the Post Graduate Hospital, New York City.

Another important feature is the ability of the system to give a variation in intensity. This can be accomplished by two, three, four, five or six-light fixtures on a three-point switch arrangement, sometimes assisted by dimmers or rheostats. A control of this kind was installed about five years ago in the Willard Parker Hospital, New York City.

Another suggestion for an auxiliary to the regular ward lighting system, or for the sole illumination provided the hospital is to be equipped with glass floors, is shown in Fig. 3. The unit is installed beneath the floor, the light reflected through same by the special arrangement of the reflecting surface. Illumination derived from a system of this character is unnatural, due to the direction from which it is received, but conditions arise where it can be used to a great advantage, as an auxiliary to the general system, for night inspection—being a very important one.

Individual bed light requires careful thought. Fig. 4 shows a fixture which can be used both for examination purposes and as a general illuminant. It is adjustable in every direction, and is equipped

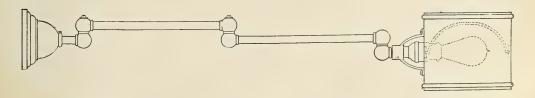


FIG. 4.—AN ADJUSTABLE BED LAMP USED IN GERMAN HOSPITAL, NEW YORK.

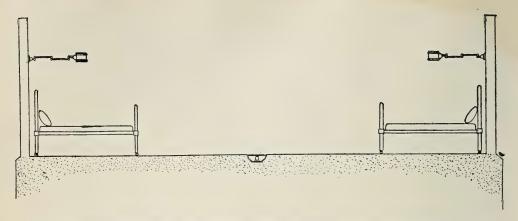


FIG. 5.—SKETCH SHOWING ARRANGEMENT FOR WARD LIGHTING IN GERMAN HOSPITAL, NEW YORK. THE FLOOR UNIT, TOGETHER WITH SPECIAL ADJUSTABLE BED UNIT.

with a reversible glass reflector having a polished surface on one side for concentration, necessary during examinations, and as an indirect unit for general illumination. The application of this unit, as well as the floor unit, is shown in Fig. 5.

Displaying Rugs by Gas Arc Light

How the Rug Displays at Sheppard Knapp & Co.'s New Store, New York, are Lighted

By J. M. Coles.

The display of rugs by artificial light, whether they are hanging upon racks or spread upon the floor, is a problem involving certain well-defined conditions. The bringing out of the large number of shades of color used in such fabrics so as to give the purchaser a fair chance to judge, would probably first suggest itself to the merchant or observer. Rugs are seen in use under two different qualities of illumination—namely, daylight and artificial light—and they may present quite different aspects under these two conditions. The difficulties of the color problem are increased by the prevailing use of analine dyes, which are of remarkable purity of color; in other words, they reflect to a large extent only a limited range of wave lengths of light, whereas the same colors, so far as the eve can distinguish by daylight, produced by the old methods of dyeing reflect a combination of different wave lengths. Taking music as an analogy, the analine colors represent simply tones, while other dye stuffs produce chords. It follows from these scientific facts that the artificial light used for showing rugs must have a continuous spectrum, which should not deviate greatly from either the spectrum of sunlight or the artificial light-sources commonly used for domestic or high-class store illumination.

The mantle gas burner appears to be the most satisfactory compromise between these two conditions of any of our modern light-sources. Its quality of light differs from daylight in having a slight excess of yellow; as ordinary artificial light is distinctly yellow or orange in color, this places the mantle gas lamp in a fairly medium position between the two. The very complete diffusion of the rays materially assists in bringing out the color values as well as the texture of the fabric. An installation of gas are lamps for this purpose in Sheppard Knapp & Co.'s new store on West Twenty-third Street, New York, is shown in use in the illustration. The lamps are Humphrey No. 30 inverted arcs, equipped with etched globes and diffusing metal parabolic reflectors placed at an angle so as to give a nearly

uniform illumination on the vertical plane of the hanging rugs, as well as the horizontal plane of the floor. The direct rays are at the same time cut off from the line of vision of an observer standing in the usual position. The illustration is a fair representation of the effect of the illumination, so far as it can be rendered without the use of color. The remainder of the installation throughout the building consists of 46 No. 30 lamps.



FIG. I.—RUG RACKS LIGHTED, HUMPHREY INVERTED GAS ARCS FITTED WITH PARABOLIC REFLECTORS.



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FIG. I.—AUDITORIUM OF THE LITILE THEATRE, NEW YORK, LOOKING TOWARD THE STAGE, SHOWING EFFECT OF THE ILLUMINATION.

Delicate Illumination for New York's "Little Theatre"

It is little, so it is, the "Little Theatre."

The arts and crafts of the architect, however, have produced an atmosphere of intimacy which, as everybody knows, is one of the most charming features of this departure in the theatre line.

However, not by any means the least of these is the delicacy of the illumination. There is a generally soft effect, just enough of the candle light and just enough of the sparkle—although the latter is entirely without the range of vision—to offer what most people probably would desire in an installation of this sort. As shown in the illustration (Fig.

1) one can get a better notion of the illumination than from Fig. 2; naturally so, inasmuch as in the former one is looking pretty much as he would from the seats. Except, it should be stated, that when actually sitting even in the rear row the chandeliers are farther out of the line of vision than the illustration shows them. While, furthermore, the side brackets have the merest suggestion of candle glow, equipped with but two candle-power lamps enclosed in frosted glass tips.

One looking at the illustrations, furthermore, does not fully realize that by far the greater part of the illumination is by indirect lighting. Examine closely the chandelier shown in Fig. 3 and you will see, as nearly as a photograph can show, how it is produced. Within the decorative beaded glass hemisphere is enclosed a bowl of cut glass. The broken rays of light which pass from within this bowl out through the beads give an ideal effect, inasmuch as the cheerful sparkle is secured, while at the same time the inner bowl and the surrounding bead work permits one to see nothing whatever of the filaments of the lamps within. The imitation candles, as with the side brackets, are very dim and purely ornamental.

As for the indirect lighting, this is produced by a copper bowl hidden completely within the upper section of the fixture, with nickel surface for reflection purposes. In each of the chandeliers within these highly reflecting bowls are twenty-four 150-watt lamps. The distribution is so arranged from these two chandeliers, pendant at half centre from the oval, that

the white paneled ceiling is evenly illuminated. There is no variation discernible on the surface. In a word, the chandeliers serve both an ornamental purpose and relieve the spectator from an uncomfortable feeling sometimes experienced with indirect lighting; and the side brackets serve a similar purpose, insignificant as they are, as units for illumination.

In keeping with the efforts of Mr. Winthrop Ames in providing in this "Little Theatre" as nearly perfect as possible a stage for presenting to a nicety the high-class plays produced at this theatre, there are several unique details in regard to the stage lighting. The footlights run in series—white, amber and blue. For the varied demands brought upon these lamps (tantalum) there are nine switches, with as many dimmers. By this contrivance (the row of footlights being divided into three equal sections—right, centre and left) a broad range of effects are possible.



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FIG. 2.—LOOKING FROM THE STAGE AND SHOWING THE ARTISTIC WALL BRACKETS, AND TWO MAIN COMBINATION DIRECT AND INDIRECT CHANDELIERS.



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FIG. 3.--THE DETAIL OF ONE OF THE MAIN CHANDELIERS.

Another especially unique feature of the stage lighting is from an arc suspended high overhead, well out of sight of the spectators, by means of which high-lights can be directed upon any person or portion of the stage setting. Furthermore, there are thirty-three pockets—"bunch lights"—where tantalum lamps are also used.

For the lighting alone, the "Little Theatre" is well worth visiting. The decorations are exquisite, but not in the least obtrusive. The illumination harmonizes with the general interior of the room which, as can be noted from the illustration, is impaneled with tapestries with walnut between.

Here you have a little theatre where the most painstaking effort has been taken to produce all of the sensitive effects that you expect to find in a large theatre, and more besides.

Too often it is said: "Here is but a small house and the lighting problem is a very simple one." When, as a matter of fact, as in the case of this "Little Theatre," little houses can well receive all the attention usually paid to big houses for the comfort and satisfaction of the resident.

As for the lighting of the "Little Theatre," as compared with many others, there is a psychological feature that one cannot afford to overlook. It is the absence of anything distracting. One, too, often finds either glare on the garish furnishings of the auditorium or on the proscenium arch, or else (quite as bad), too much or too little lighting for the stage appointments—and the people on it. With such high ideals as has prompted the existence of the "Little Theatre," it is refreshing, indeed, to note the motive in securing such stage illumination as to give the players and the scenic artists every opportunity to show their best.

A New Interchangeable Electric Lamp Letter Sign

As advertising by word has become more and more recognized as business producing, for day as well as for night, the ingenuity of advertising specialists has from time to time been improving upon previous methods.

Aside from advertising, as it is commonly understood, there is a growing demand for the use of words for purposes of directing people as to where to go, as well as where to come.

For instance, around railroad stations, theatres, auditoriums, hotels, clubs, banks, manufacturing plants, newspaper offices, etc., it is often of great importance to the people themselves to get the information, as it also relieves those connected with such institutions of the annoyance of being continually asked questions as to this or that.

An ingenious method of fulfilling such advertising and instructive purposes is an electric sign system in which each of the letters is an individual lamp, and clearly visible day or night. By day these letters are conspicuous, because they are "backed" by white plaster, which incidentally serves the purpose of carrying and protecting wires which feed the tiny filaments which are set into the rear, enclosed in glass. An advantage claimed from this form of an electric sign is that

the letters are interchangeable and can be varied from time to time as the case may be. As an example, a storekeeper might want to change a price-mark shown with a certain class of goods advertised; in fact, he might desire to change the wording of his window display entirely. Special announcements could be made at short notice. The lamp letters are 31/2 ins. in height above the porcelain base, on which each letter or character is mounted. and the letters are so constructed that they may be assembled in any way the case may require. The change of wording can be done at any time and a new combination immediately produced. A feature of this system is its economy. Its lamps are operated at 110 volts each, each letter consuming one-tenth of an ampere. Each letter requires 11 watts, so that it can be figured that five letters require practhe same energy as that used 16 c.-p. carbon lamp. They are adaptable for either direct or alternating current.

Adjustable metal fixtures are supplied in connection with the use of these lamp letters, and are so simple in construction and easily set up for use that no expense is necessary in assembling either the fixture or the letters in making up such signs as are required.



FIG. I.—A NEW AND NOVEL ELECTRIC SIGN SO CONSTRUCTED THAT EACH INDIVIDUAL LETTER

IS A SEPARABLE LAMP UNIT.

EDITORIAL

Cheaper Light Means Larger Use

The fact stated above is only a special case of a general law. Within certain limits the cheapening of any commodity will always increase its use. There was much fear expressed, or felt, when the tungsten lamp first made its appearance that the reduction in consumption of current would mean a proportionate reduction in revenue to the central stations. While there was a readiness to accept the principle above stated as a general proposition there were doubts as to how the theory would work out in practise. Events have proven that the theory held good in this as in other cases. Americans are not small economists; they dislike trouble and wear, and will pay liberally for relief from these evils. To need to have it on one's mind to chase around the house and turn out electric lamps the moment they are not absolutely needed is not conducive to cheerfulness. Furthermore, there is a rapidly growing appreciation of art, especially in reference to the home. artistic treatment of illumination invariably means waste of light, or rather we should say the use of light, for it is not waste if it accomplishes a desired end. The bare, glaring electric bulb which had been an offense to the eyes, as well as to the mind, could well be replaced with the more artistic and far more comfortable decorative globe or shade which hid the lamp and softened its rays.

The latest refinement in the tungsten lamp opens up still another channel for the greater use of light. This is the 10-watt lamp. When the people understand that a 10-watt lamp means about one-sixth of the current that they once used in the ordinary 16 c. p. bulb they will make liberal use of them for continuous night burning in hallways, bathrooms, porches, etc. Give the American a little time to think and he will always find a way to spend in some new direction what

he has saved in another. And this is well. What is economy if not a wise use of money? Let the scientists continue their search for more efficient light-sources, and the manufacturers their efforts in placing their discoveries on the market as cheaply as possible. It will all come out for the best in the end.

Education and Commercialism

The change that has come about in the methods of promoting the sale of goods, and especially of introducing new articles within the past fifteen years, is worthy of the serious study of all students of political and social economy. Selling to-day may be defined in the exact words with which Demosthenes defined oratory: the art of persuasion.

The enormous multiplication of printed matter has largely usurped the power held by the old-time orator, and while the oration has passed, the art of persuasion has been cultivated in another channel—that of salesmanship. The best paid and the most convincing writers of the present time devote their energies to commercial writing, i.e., advertising copy and commercial literature. Commercialism has been elevated by this change. The persuasive appeal to-day depends upon sound logic, clear cut language, human interest viewpoint and a solid basis of fact. The day of the preposterous, unsupported claim of excellence, backed up by racy stories and liquid inspiration, is no more. As sources of reliable, technical and special information, our manufacturing concerns are scarcely second to our great public libraries, and are vastly more accessible to the public, since they furnish their information promptly and without charge, without requiring the time and familiarity necessary to gather the information from the latter sources.

Selling campaigns are invariably campaigns of public education. To be specific,

the origin and development of illuminating engineering, including the Illuminating Engineering Society, is a direct result of the educational methods used by the manufacturers of lighting devices.

It may be admitted offhand that this valuable work of public education was carried on in the beginning for the express purpose of reaping financial advantage from the results. But this does not lessen the value of the results to the public one whit. Truth is truth, and fact is fact no matter from what source it emanates, or from what motive it is advanced. The definite movement toward illuminating engineering in this country began with the exploitation of prismatic glassware, and those commercially interested in every new invention, discovery or improvement in the field of illumination since then have joined in the educational campaign primarily for their own commercial advancement, but ultimately to the great benefit of the public. G-E-M, tungsten, flaming and magnetite electric lamps, the gas arc and the inverted mantle burner, indirect lighting fixtures and the various improved forms of reflectors and globes, have all fallen in line and added their strength to the educational work.

There is no more reason for looking askance at the real bona fide educational work carried on by these manufacturers as a means of promoting business than there is for questioning the soundness of the technical training given in schools endowed with the proceeds of commerce. To such an extent is this educational method pursued in the lighting field that one of the best equipped and manned laboratories for research in pure science in this country is maintained by a company having large commercial interests in illumination.

It is generally admitted by those competent to judge that America is the best lighted country in the world. While equally good examples of illumination can doubtless be found in all civilized countries, we excel because of the greater number of good installations. We may fairly call our commercial practises of the present time the "new" commercialism. It represents as great a forward step in civilization as our democracy represents over

the monarchical idea which it superseded.

The "new" commercialism is based upon merit and honesty in the goods sold, fair representation of their relative merits and the utmost of service to the buyer by way of information and instruction.

Illuminating engineering is a direct result of the "new" commercialism.

Spare the Fire and Save the Child

Along with the general movement for a safer and saner Fourth of July there has come up this year an instance of decorative illumination which gives more than good promise of further development to come along this line. Particular attention is directed to an article appearing elsewhere in this issue on the electrical illumination this last Fourth in New York. Not only were the electrical displays generally enjoyed and appreciated by old and young alike, but the exhibitions have served as such an object lesson that there is every prospect of all sections within the confines of the boroughs of Manhattan and the Bronx next year adopting electrical illumination to supplant the usual fireworks.

Just as the fire-cracker has become extinct in New York so do the fireworks displays stand in a position to follew suit. In the districts above mentioned forty-three aldermen each received for his respective bailiwick the sum of \$300 to be expended on illumination for celebration purposes. Of these forty-three, eighteen this year directed their appropriation to electrical displays, and a careful investigation seems to indicate that next year all of the money so appropriated by the city will be devoted to electrical displays. As pointed out in the article to be found elsewhere in this issue, electrical illumination proved most attractive, and, not of the least consideration, lasted longer; no mere "flash in the pan," no damage done, no men or children (especially the children) were injured—and, furthermore, none of the little ones were half scared to death by the brutal noise and highly sensational features accompanying fireworks. This last named feature should not be lost sight of. The study of the young mind is constantly developing a recognition of the importance of protecting the child as far as possible from noise, startling effects and all else that might serve to terrify.

Reports from various parts of the country further go to show that the "electrical safe and sane Fourth" is being recognized in the light of its proper worth. Around New York, in several of the towns and among the country clubs, the fireworks appropriations were diverted to electrical displays. At one of the country clubs, in particular, it had been customary to devote quite a sum every year to go up in fire and smoke.

This year at a far less appropriation clubhouse grounds and verandas were artistically decorated, giving them—even parts of the golf course and the tennis courts—a really festive appearance.

What Next in Spectacular Lighting?

The use of electric lamps to trace out decorative devices, or to outline the architectural features of a building for spectacular effect reached a state where new and original adaptations would be welcome. While the effects produced are none the less beautiful in themselves than when they were first blazed forth to an astonished world at the World's Fair in Chicago, they have become familiar and trite, and nothing is spectacular no matter how gorgeous or originally startling that is familiar. Novelty is an absolute essential to spectacular effect. If a building burned down every day within our block it would very soon cease to be anything but a bore.

The effects producible by the flasher have also become common through familiarity. The question of how to produce a genuine spectacular effect with electric light is now a serious and difficult one; serious for those who desire to use it, and difficult for those who have it to produce. What can be done to produce an entirely new vision? What new combination of old principles is possible? How can the recent improvements in electric lamps be impressed into the serv-

ice? The solution of these problems is a prize worth working for.

We are to have an international celebration in San Francisco three years hence. It offers enormous possibilities for spectacular illumination, and anything of novelty and beauty will certainly be most eagerly taken up by the management. Here is an opportunity for the genius to blossom. It is none too soon to put your thinking-cap on. Let us show the world that we have originality.

Gas Street Lighting

It still remains a matter of curiosity to the lav observer that gas is not taking its part in the country-wide movement for better street lighting. The few instances in which installations of modern gas lamps have been put in seem to leave no reasonable explanation for the continued failure of this illuminant to take its place in the race for better public lighting. So far as the illumination produced is concerned, it will bear comparison with the very best systems of its competitors, and in point of appearance it need not be second. Is it that there is not a thoroughly reliable outside gas lamp, or is it the lack of aggressive business methods on the part of the gas interests, or, again, is it due to combination companies, or the desire of the gas people to keep away from public contracts as far as possible? If gas is a cheaper illuminant for interior use than electricity, it ought also to be a cheaper exterior illuminant, and the fact that it is still used with old style lamps and apparatus would seem to indicate that it can hold its own on this score. We want to see better public lighting become universal, and we believe that this is a case in which competition would be beneficial not only to the public, but to those competing. Every one knows that when a State or community is of the same political complexion year after year abuses creep in. The right kind of competition has a purifying influence. We should like to see gaslight have a better showing in this new field.

TECHNICAL SECTION

SOCIETIES

For creating appreciation for the improvements in illuminating engineering one of the most significant events was the Electric Lighting Section at the annual convention of the American Institute of Electrical Engineers, which took place in Boston, this special section occupying the entire day's proceedings, June 26.

Mr. Bassett Jones, Jr., presented a paper on the problems of interior illumination. Mr. Jones is always interesting. His paper well served its purpose to arouse a spirit of co-operation between the electrical engineer and the illuminating engineer.

At the outset Mr. Jones entertained his audience with the general outline as to the aims of the illuminating engineer. In

part he said:

"As a matter of fact, one's work is efficient when, with a minimum of means, one succeeds in accomplishing what one sets out to do. But the accent is always on the suc-

"It does not matter whether what is accomplished is the generation of 50,000 kw. at Squeedunk Falls and its transmission to Bisonville, the construction of a hundredstory building, the ornamentation of a wall, the carving of a marble Venus, or the salvation of lost souls, the same rule applies, and, by the same token, it is, within reason, the result rather than the means by which the world will gauge such work. You, as engineers, may sit in judgment upon the fractional percentage avoidable loss in the Squeedunk-Bisonville line, but the citizen of Bisonville judges only by the constancy and general satisfaction of the service.

"So, in the artificial illumination of interiors such as we shall study, the gauge of efficiency can only be applied when we appreciate and understand the results accomplished, whether these results be the proper illumination of the working areas or attainment of proper shadows and color values in the architectural design or both. Usually both results must be obtained. Hence this

complexity of the problem."

Mr. Jones thereupon covered, as nearly

as could be expected of anybody in one presentation, the way the illuminating engineer goes about his work. His paper certainly aroused great interest, and should result in a livelier co-operation in the future between the electrical and

the illuminating engineer.

The paper by Mr. C. E. Clewell, "The Industrial Illumination and the Average Performance of Lighting Systems," took up in considerable detail the various problems met with and their solution, with special emphasis on the necessity of studying closely the interior construction of buildings to be lighted and the various kinds of manufacturing, much of which requiring special consideration. A feature which received much attention was his treatment of the important relation of wages to illumination. In this connection he stated:

"In one large shop where extensive installations of high efficiency lamps have been under way for nearly three years, a sum-mary shows an increase of nearly 30 per cent. in actual candle-power for a 5 per cent. increase in total operating and maintenance costs. This increase of 30 per cent. in candle-power in no way, however, indicates the enormous improvements in the matter of excellence in distribution and refinements of results; it merely shows what great advances have been made in the possibilities of industrial illumination by the newer types of lamps. Added to this candle-power increase there are, of course, many advantages which have been brought about by the careful and scientific adaptation of the best suited lamps to each condition."

Dr. H. E. Ives, at the time connected with the Physical Research Department of the National Electric Lamp Association of General Electric Company, gave interesting lantern slide lectures on color.

Dr. Louis Bell directed the attention of the electrical engineers to the work which is being done by the Illuminating Engineering Society, not only by entering into the more abstruse sides of the question, but also in the preparation of matter of an elementary character for those constantly entering the field and requiring for the outset the most simple matter available. He made special reference to the "Primer," which the Illuminating Engineering Society is compiling.

The annual convention of the Michigan Electrical Association, as for years past, was an outing on the Great Lakes from June 21-25. President R. W. Hemphill of Ann Arbor stated in his address that in Michigan 291 central stations served approximately 2,500,000 people, while there are 103 municipal plants, of which 17 do only street lighting. He advised those present to seek the highest possible efficiency in their operating forces. He pointed out that in Michigan there is a tendency toward eliminating small municipal stations by means of combination into great systems.

Mr. D. M. Diggs of the General Electric Company, Schenectady, N. Y., presented an interesting paper on street lighting, explaining fully the details of the new inverted magnetite arc and other methods of electric street lighting.

At the convention of the Canadian Electrical Association, held at Ottawa, June 19-21, Mr. J. G. Henninger gave a paper on illumination, pointing out specially the improvements in lighting of large industrial plants by means of proper reflectors in connection with 500-watt incandescent lamps. In the discussion H. B. McDunnough stated that he thought this paper would be of unusual value to the managers of central stations and small cities, who can get closely in touch with their consumers in advising them as to proper methods in lighting.

The twelfth annual convention of the National Electrical Contractors' Association was this year held in Denver, with the registration of 251, including wives and guests of the delegates. H. H. Cudmore, representing the National Electric Lamp Association, was the chief speaker along lines relating to promoting illumination, pointing out the value of co-operation in giving increased value to the consumer by means of modern lamps and business methods. His suggestion that a permanent committee representing the association be appointed for the purpose of meeting committees representing other organizations to the end of co-operation was accepted. A committee will be selected later. Ernest Freeman, of Chicago, was elected president, to succeed M. L. Barnes, of Troy, N. Y.

The Ohio Electric Light Association had its convention at Cedar Point, Ohio, July 16 to 18. Its registration was 480, the largest ever held by the association. President W. C. Anderson, of Canton, in his annual address aroused much interest regarding the recent advancement made both in the manufacturing of lamps and in co-operative methods for promoting good lighting. Mr. J. C. Martin, of Wilmington, was elected president to succeed Mr. Anderson.

The Pennsylvania Electric Association, State branch of the N. E. L. A., will hold its fifth annual convention September 4 to 6, at Bedford Springs, Pa. The lamp committee of the association is making a careful investigation of the new tungsten lamps for street illumination and other special uses, and it is expected that many new ideas will be brought out.

A special meeting of the New York Section of the Illuminating Engineering Society is called for August 1 at 8.15 p.m., when Mr. Leon Gaster, honorary secretary of the British Illuminating Engineering Society, will deliver an address on "Résumé of Progress in Illuminating Engineering in Europe."

Programme for the Sixth Annual Convention of the Illuminating Engineering Society, to Be Held at Hotel Clifton, Niagara Falls, Ont., September 16 to 19, 1912

There are stirring times ahead—and not so far distant at that-for those concerned in the latest development in light-

The forthcoming annual convention of the Illuminating Engineering Society at Niagara Falls promises to be a sharp, crisp sort of affair.

Many men of many minds will be there and, quite apart from the remarkably high character of papers, there bids fair to ensue discussions which will outclass anything which shall have occurred in this country since the movement for better lighting conditions took definite form.

1-Report of Committee on Progress. This report will deal with the recent progress and developments in the lighting industry, both in this country and abroad.

2—A report of the Committee on Nomenclature and Standards, which will deal with certain definitions and terminology of illuminating engineering.

3—"Steel Mill Lighting." A report of the Committee on Illumination of the Association of Iron and Steel Electrical Engineers. To be presented by the chairman, Mr. C. J. Mundo.

4—"High Pressure Gas Lighting," by Mr. F. W. Goodenough, chairman of committee, Illuminating Engineering

Society, London.

5—" The Status of High Pressure Gas Lighting," by Mr. George S. Barrows. This paper will be a collation of domestic and foreign correspondence pertaining to high pressure gas lighting.

6--" Recent Developments in Gas Light-

ing," by Mr. R. F. Pierce.

7—" Indirect and Semi-Indirect Illumination," by Mr. T. W. Rolph.

8—"Recent Developments in Series Street Lighting," by Dr. C. P. Steinmetz.

9-" Research Methods," by Dr. E. P.

Hyde.

"The Problem of Heterochromatic Photometry and a Rational Standard of Light," by Dr. H. E. Ives.

11-" Reflection from Colored Surfaces,"

by Mr. Claude W. Jordan.

12—" Diffuse Reflection," by Dr. P. G. Nutting.

13—"A Study of Natural and Artificial Light Distribution in Interiors," by Mr. M. Luckiesh.

14-" The Physiology of Vision," by Dr.

T. A. Woodruff.

15—"The Efficiency of the Eye Under Different Systems of Illumination," by Dr. C. E. Ferree. This paper will be a report of a research carried on for the American Medical Association.

16—"A Proposed Method of Determining the Diffusion of Translucent Me-

dia," by Mr. E. L. Elliott.

17—" Illumination Charts," by Mr. F. A. Beuford.

18—" The Determination of Illumination Efficiency," by Mr. E. L. Elliott.

19—"An Absolute Reflectometer," by Dr. P. G. Nutting.

- 20—"Colored Values of Illuminated Surfaces," by Mr. Bassett Jones, Jr. This subject will be presented in the form of a series of experimental demonstrations.
- 21—One session will be arranged for a potpourri, at which discussions will be in order on miscellaneous phases of illuminating engineering. It is expected that this session will bring out interesting and valuable points not particularly covered by the above papers and reports.

The scenic wonders of the Falls render possible an entertainment programme which will surpass that given at any previous convention of this society.

Inspection tours of the power houses and other wonderful development enterprises peculiar to this location have been arranged for.

Reduced railroad fares will be available for delegates.

CURRENT LITERATURE

New Book

Those not having had the opportunity of hearing or otherwise securing the Centenary lectures delivered at the Centenary Celebration of the First Commercial Gas Company, held at the Franklin Institute, Philadelphia, Pa., April 18 and 19, will be glad to know that this valuable matter can be secured in book form, bound in cloth, 180 pages. Price, \$2. The book is edited and published by the American Gas Institute, 29 West Thirty-ninth Street, New York City. The only thing

lacking in the book would seem to be the absence of the personality of the lecturers and those who discussed the lectures, and by no means least of all the keen atmosphere of interest which pervaded the centenary celebration. The book is one to have and to keep, as it contains much information not only of an historic character, but of present-day usefulness. The book is illustrated with the photographs of the speakers. A number of the papers are accompanied by illustrations, giving technical and practical information, tables, etc.

American Items

Electrical World:

LIGHTING LARGE ASSEMBLY ROOMS, by Albert Scheible; June 29.

ELECTRICAL DISPLAY AT PORTLAND ROSE FESTIVAL; July 6. DAYLIGHT LIGHTING; July 6.

NEW YORK'S ELECTRICAL FOURTH; July 13. SPECTACULAR ILLUMINATION AT THE BAL-

TIMORE CONVENTION; July 13.

ILLUMINATION OF ST. LOUIS' PUBLIC LIBRARY, by G. T. Hadley; July 13.

HOUSTON'S DOWNTOWN MAGNETITE ARC LIGHTING; July 20.

A PHOTOGRAPHIC METHOD FOR RECORDING

CANDLE-POWER DISTRIBUTION CURVES, by

H. E. Ives and M. Luckiesh; July 20. French and German Quartz Tube Mer-CURY VAPOR LAMPS, by Warren H. Miller; July 27.

COMPARING GAS AND ELECTRIC LIGHTING Costs; July 27.

ELABORATE LIGHTING OF HOTEL UTAH, SALT LAKE CITY; July 27.

Electrical Review and Western Electrician:

OUTDOOR WIRING FOR INCANDESCENT LAMPS, by H. G. Wilson; July 13. WIRING FOR POWER AND LIGHT IN A PRINT-ING OFFICE; July 13.

THE ELECTRICAL ILLUMINATION OF NEW YORK CITY ON INDEPENDENCE DAY; July

PRACTICAL INDUSTRIAL ILLUMINATION PROB-LEMS, by C. E. Clewell; Electric Journal,

July. ARTISTIC POSSIBILITIES IN CAR LIGHTING FIXTURES, by L. Schepmoes; Railway Elec-

trical Engineer, July. Acuity Tests in a Particular Room Il-LUMINATED IN TURN WITH DIRECT AND IN-DIRECT LIGHTING, by Prof. Sidney W. Ashe; General Electric Review, August.

OME PHYSIOLOGICAL CONSIDERATIONS IN LIGHTING PROBLEMS, by W. F. Schaller; General Electric Review, August. Some

STORE LIGHTING INSTALLATION WITH MAZDA LAMPS, by A. L. Powell; General Electric Review, August.

A Convertible Lighting Mazda Unit: Gen-

eral Electric Review, August.

PRIVATELY MAINTAINED STREET LIGHTING A Modern Development; Electric City, July. SIMPLE METHODS OF GOOD LIGHTING, by W. A. Durgin. Chapter 5, The Control of Light; Electric City, July.

INDIRECT LIGHTING IN PARKWAY THEATRE,

CHICAGO; Electric City, July.

STORE WINDOW LIGHTING, by Philmer Eves; Progressive Age, July 1.

LIGHTING A PHILADELPHIA ART SCHOOL, by James D. Lee; Progressive Age, July 1. PRACTICAL COMPARISON OF DISTRIBUTION Curves, by R. F. Pierce; Progressive Age,

August 1. ILLUMINATING GAS IN LIQUID FORM, by W.

O. Snelling; Progressive Age, August 1. Atlantic City's Store Lighting; Progres-

sive Age, August 1.
New Method of Recording Candle-Power, by Dr. Leonard K. Hirschberg;
American Gas Light Journal, July 29.

Understanding the Gas Burner and Its Use in Illumination, by R. F. Pierce; National Commercial Gas Association Bulletin, July.

INDUSTRIAL LIGHTING; American Silk Journal, August.

LIGHT AND ITS VELOCITY, by R. L. Olden-

bourg; Optical Journal, July 18.

The Wonders of Light, by J. Gordon Ogden; Popular Mechanics, August. Chapter 6, The Illusions of the Eye.

Lights That Won Business; Dry Goods

Reporter, July 6.

EDITORIALS.

Electrical World:

LIGHTING OF LARGE ROOMS; June 29.
PHOTOGRAPHIC RECORD OF CANDLE-POWER DISTRIBUTION; July 20.
The QUARTZ MERCURY ARC LAMP IN

PRACTISE; July 27.

Electrical Review and Western Electrician:

WIRING FOR WINDOW ILLUMINATION; July

EXTRAVAGANCE OF POOR ILLUMINATION; July 13.

MAKING THE MOST OF TUNGSTEN LAMPS; July 27.

Eye-Strain; Optical Journal and Review; July 18

NORMAL VISUAL ACUITY; Optical Journal and Review, July 18.

IN THE PATH OF PROGRESS

New Publications

Engineering Data on Modern Illumination, by Frink Reflectors and the J-M Linolite System, is just received from the H. W. Johns-Manville Company.

This compilation (hand book No. 409) shows the result of the close and intimate knowledge of the illuminating engineering profession, and what is required by it. Far from being a profuse or elaborate compilation, at the same time it contains condensed vital information so arranged as to enable one to immediately secure what he is after. Of not the least importance, as a matter of co-operation, is a chapter on the services of the Engineering Department of the H. W. Johns-Manville Company, giving the reader at the outset just what it can do and the information required to enable the department to render satisfactory service.

Following comes a useful list of definitions, data and tabular matter, and illumination values required for various purposes. The booklet comprises, furthermore, in separate sections, thumb indexed, Lamp Data, Showcase Lighting, Picture Lighting, Cove Lighting, Show Window Lighting, Outlining and Sign Lighting, Type Rack Lighting, Bank Lighting, Lighting Specialties, General Applications and Test Data.

The book is loose leaf, with buckram

binder.

Gill Brothers Co., of Steubenville, Ohio, presents complete information on its new line of Parian illuminating glassware in a booklet of 36 pages, which has attracted unusual attention from those who have seen it.

One cannot review the thirty-six pages contained without being impressed with the completeness of information offered by means of which the illuminating engineer, architect, central station man or dealer can compute the various efficiencies produced by the several shapes and types of Parian glassware under varying conditions. Tables are given showing complete information, opposite to which are clean, clear-cut illustrations of the various kinds of glassware. Photometric curves are given, covering nearly all of the glassware shown.

Illuminating engineers and all others interested in good lighting, as one of the recognized means for increasing human efficiency, should be interested in the work being undertaken by the Efficiency Society, the address of which is 29 West 39th St., New York. A booklet has been issued which explains its purposes as indicated in the constitution. The object of the society is to "promote efficiency or percentage of result obtained relative to effort expended in every activity of man and in everything he employs."

From the Macbeth-Evans Glass Co., Pittsburgh, we are in receipt of a booklet (No. 53) on "Lighting the Atlantic City Boardwalk." This booklet presents both night and day views of the new installation there made, where Alba globes are used. The illustrations are remarkably good, and the information contained therein is such as to interest most everybody, although designed rather more for the attention of the layman than the illuminating engineer.

A booklet on lamp advertising, emanating from the Department of Publicity of the National Quality Lamp Division of General Electric Co., Cleveland, is presented to us, entitled Mazda Ad Book.

The book consists of 32 pages. As stated at the outset, the booklet has a single purpose of presenting to the reader newspaper advertising copy to help those interested to co-operate with the central station man, electrical dealer or contractor. The advertisements are

capital, on the whole, and show what splendid progress is being made in lamp advertising; to fairly, clearly and attractively setting before "Mr. and Mrs.," and any others, the service which the Mazda lamp can render. It is announced that electrotypes of all illustrations, either for double or single column advertisements. will be furnished free upon request. Among the special advertisements offered for use on request are those entitled "The Home Healthful" (associating healthful lighting with sanitary plumbing, etc.); "Proper Home Lighting" (electric light no longer a luxury, because of its inexpensiveness); "Light Makes Gladness," Mazda in reach of the workingman as well as for the millionaire; "A Blow to the Cost of Living" (citing comparisons where the cost of lamps has been reduced while that of other commodities has been raised); "Save the Children's Eyes"; "Why Ruin Your Eyes"; a "good word for the modern wireman"-all about "fishing" wires, little trouble, little expense, etc.; and many others. book is a refreshing departure from the dull and stupid matter which all too often has crept into lamp propaganda in the past.

"Between Ourselves" is the introductory word of a brochure for the purpose of "acquainting the world's buyers and sellers of advertising with the Bickley Motograph." The readers are informed through this brochure the results secured by the Bickley Motograph. The instrument is described in another section of this number. The booklet explains the fire points regarding the Motograph, why it is popular, fascinating and a business producer. The apparatus is being marketed by the Electric Sales Company, Detroit, Mich.

Personal

Dr. Herbert E. Ives has made a change to become physicist in the research laboratory of the United Gas Improvement Company, Philadelphia, after some four years of association with the physical laboratory of the National Electric Lamp Association, Cleveland, Ohio.

Dr. Ives, although but a young man—he was born in 1882—has achieved remarkable results. Not only has he been a tireless student and investigator, but he has combined with this the faculty of expression, to be found both in his writings and lectures, which has helped the science to which he has been devoted to a degree quite unmeasurable. He is certainly uncommonly interesting.

Dr. Ives is a Philadelphian, the son of Frederick E. Ives, who invented the halftone engraving process and three-color photography, as a result of which he was

awarded the Rumford medal.

Dr. Ives got his early education in Philadelphia, later going to the University College School, London, the Rugby Lower School, Rugby, England, and returned to this country and received the degree of B. S. from the University of Pennsylvania, 1905; Fellow in Physics, 1906-8; Ph.D., 1908, Johns Hopkins University. From 1908 to 1909 he carried on most important work as assistant physicist of the Bureau of Standards, Washington, from there going to the National Electric Lamp Association at Cleveland.

Dr. Ives is giving special attention to the investigation of illuminating engineering—into its production, measurement and utilization. He furthermore has made close investigation of the Lippman color photography, and was the originator of a method for estimating daylight efficiency of illumination. Dr. Ives is a member of the American Association for the Advancement of Science, the American Physical Society and the Illuminating Engineering Society (vice-president 1911-12) and a corresponding member of the London Illuminating Engineering Society.

Mr. B. H. Hagedorn has recently taken the position of manager of the Chicago office of The Haskins Glass Company, Wheeling, W. Va., which was recently vacated by Mr. A. H. Krom. Mr. Hagedorn has had charge of the Southern territory for The Haskins Company for

a number of years.

GOOD LIGHTING

AND THE ILLUMINATING ENGINEER

ALBERT JACKSON MARSHALL, Editor.

H. A. BUCK, Business Manager.

Vol. VII

AUGUST, 1912

No. 6

Coördination—Coöperation

- ¶ Involved in the creation and use of Light are Physiology—Psychology—Aesthetics—Physics—Chemistry—Engineering.
- ¶ The intelligent—unbiased—coordination of these factors, and their proper applications to various conditions, is the object of those broadly interested in Light.
- ¶ To realize such ambition, unity of purpose must be evident.
- ¶ Coöperation by ALL concerned will establish a more nearly correct basis of relative values for all conditions.
- GOOD LIGHTING will coördinate and coöperate.
- ¶Future issues will demonstrate.

ALBERT JACKSON MARSHALL.

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Novel Searchlight Advertising in Baltimore

National Democratic Convention visitors and all Baltimoreans out on the street after dark were familiar with the brilliant, startling, ever-changing searchlight effects, in white light and in color, that were flashed nightly from the top of

the new Fidelity Building.

In these novel effects first came the huge majestic fantailed beam of pure white light that flashed out over Baltimore city, the bay, and the distant suburbs. With movement for all the world like the arm of an immense giant, this big, solid white beam radiated outward and, with the Fidelity Building as a center, marked, once a minute, its wondercircle about the city.

Then something happened. Suddenly the big beam was seen to change as it swept along. Now it quivered with the rapidly changing, vibrating color. Red and green, orange, pink, and yellow, and back again to white. All these had their turn, and still the big beam swept on. But this was not all. Again, the great shaft of light was seen, chameleon-like, to change its color throughout its entire length. But this time it broke in two, a tiny shaft of light darted up into the air and the big horizontal beam faded away, only to be replaced by a great perpendicular shaft of changing light projected upward into the sky at the zenith. Down it came again. It has been up in the sky only for an instant, and now it proceeded on its long journey over the bay, city, and suburbs. These and many other combination electrical color schemes were effected by the Fidelity Trust Company's appar-

It was a realization that a continuous exhibition of merely the slow rotating beam of white light, fascinating as it would be at the start, would soon lose its charm, that led to the production of the apparatus illustrated in the accompanying photograph.

The searchlight proper which had been courteously placed at the disposal of the Fidelity Trust Company of Baltimore by the Consolidated Gas, Electric Light & Power Company, was mounted as shown

in the picture in the center of a supporting platform. This platform surmounted one of the elevator houses on top of the building. The searchlight thus found a setting on one of the highest points in downtown Baltimore.

The apparatus in its entirety consists of the supporting platform, the searchlight proper, a motor in the base of the searchlight for revolving it, four large light-oscillators, or projectors, and the col-

oring apparatus.

The searchlight proper has a diameter of 24 in.—i. e., it throws a beam of light 24 in. in diameter. The motor in the base of the searchlight is run by the same source of current that feeds the light But it may be started and stopped without in any way interfering with the light The angle of the beam of light may easily be adjusted by hand, and the lamp locked into position by a thumb nut.

It is the arrangement of the four oscillator-projectors, the construction of the projector supports and the method of coloring the beam with the color apparatus,

that are of peculiar interest.

A glance at the picture will reveal that the projectors are located one at each of the four corners of the platform railing. Each projector, or oscillator, is carried by a supporting frame of peculiar construction. These frames are so built that any one or all of the four projector-oscillators may be set at any angle desired relative to the beam of light. Or, any or all the oscillators may be revolved on the bearings, and at the same instant be swung about. In a word, the construction is such as to permit of, so to speak, universal movement.

Directly over the center of the searchlight is hung the horizontally revolving color mechanism. This device produces and varies the four colors in the beam.

With the above brief and general description it is easy to understand how a great variety of light effects may be obtained with this apparatus.

Assume, for instance, that the searchlight makes one turn, horizontally, about the horizon per minute, and that the pro-



NOVEL SEARCHLIGHT IN BALTIMORE.

jectors are set stationary and at a right With the apparatus thus arranged the big white beam would first sweep along horizontally until it struck the first projector-oscillator. It would now begin to split, and part of the beam would dart up perpendicularly into the sky. In a moment the entire beam would be, literally, "up in the air." Then a portion splits off and darts out horizontally, only to be followed in an instant by the full white beam, which then proceeds on its way to the next projector.

With the searchlight thus working automatically in connection with the inclined projectors, the operator now rotates his color mechanism. Instantly the beam, whether horizontal, split, or perpendicular, becomes alive with scintillating

varying color.

Further, if the operator so desires, any or all of the projectors may be oscillated so as to throw the beam, as it travels over them, backward and forward across the heavens, or any projector may be rotated with the searchlight stationary so as to throw, or swing, beam after beam, so to speak, in quick succession across the sky and down on to buildings, etc. Or the beam, filled with one color, or full of scintillating colors may be turned on to the street to illuminate processions, live steam, etc.

The apparatus only has to be inspected in order for even a casual observer to understand how many combination effects there are that can be produced by a think-

ing manipulator.

One interesting effect that caused considerable amusement at the time of the night convention parades was the use of one of these projector-oscillators to illuminate processions on Charles, Saratoga, and Lexington streets. The parade of the Princeton-Wilson men was an instance of this kind. The Princeton men were caught by the orange beam from the Fidelity oscillator at Franklin Street, and followed on their march down Charles Street around to the Rennert Hotel, and up Lexington Street from the gas office to the Fidelity Building.

These novel searchlight effects and apparatus were designed by Frank L. Perry of the executive staff of the Fidelity Trust Company. Superintendent Noah R. Pierson, of the Fidelity Building, and Thomas W. Rogan, were in direct charge of the construction and operation of the apparatus to produce these splendid novel

electrical effects.

The searchlight proper was managed during the illumination by Messrs. Joseph Fischeffer and J. Benn, of the Consolidated Gas, Electric Light & Power Company.

The Value of Good Illumination as Regards Health and as a Means of Preventing Accidents

By LEON GASTER.

(Abstract of paper read at the Congrès Technique International de Prévention des Accidents du Travail et d'Hygiène Indusrielle, Milan, May 27-31, 1912.)

The subject of the applications of light in industry is an exceedingly important one at the present moment, and it was with great gratification that I accepted the kind invitation conveyed through your distinguished Secretary, Sig. F. Massarelli, to read the present paper. There are few subjects, I suppose, which have made more rapid strides than industrial hygiene during the last few years. The Second Congrès International des Maladies Professionnelles, held in Brussels in 1910, drew public attention to the excellent work that is now being done all over the world to make labor and industry safer and more congenial to the worker, and I venture to think that the present congress will, in future years, be looked back upon as marking another great step forward.

The opportunity of bringing forward the claims of good illumination on this important occasion is, therefore, very wel-The technical side of lighting already forms a vast subject. I may remind you that Sig. Massarelli has already reviewed the progress of illuminants in

his admirable recent paper at the Congrès at Brussels. It is my intention to deal with their applications, from the standpoint of those responsible for the health and safety of workers—the manufacturers, the sanitary and hygienic experts, the inspectors, etc. Many matters in connection with industrial hygiene, such as ventilation, good water supply, etc., now receive close attention, and I venture to believe that good illumination will soon be regarded as demanding equally careful supervision.

To the hygienist and sanitary expert the value of light is conceded for two main reasons: (1) its direct influence on the health of workers, and (2) its importance as a means of reducing the number of industrial accidents. It is my intention to deal with these two points in order, laying special stress on the influence of conditions of illumination on the frequency of accidents, a subject of the greatest interest to a congress of this kind.

In referring to the effect of illumination on health, a distinction must be drawn between daylight and artificial light. The importance of securing adequate admission of daylight to workrooms was recognized by authorities even before they had begun to consider artificial light. For example, the Building Acts in Great Britain and the recommendations of the London County Council on school-lighting included clauses specifying the desirable area of the windows for a given floor-space, etc. Special emphasis has also been placed on the value of abundant daylight in the legislation affecting such trades as enameling, glasswork, etc., where there is a possibility of lead-poisoning, and in connection with industries in which special precautions are desirable to avoid a tendency to tuberculosis.1

It need hardly be said that habitual insufficiency in daylight illumination imposes a strain on the eyes of workers engaged in such work as printing, knitting, sewing, etc., but this is only one among many of the evils induced by want of light.

As an illustration of the growing recognition of the need for adequate daylight illumination, I cannot do better than

quote the conclusions embodied in the report of H.M. Chief Inspector of Factories in Great Britain for 1909:

"The importance of adequate lighting in industrial employment is obvious as a matter of safety, especially where dangerous processes are carried on; as bearing upon health in many ways, directly and indirectly, and as a condition of efficient work. On the health side of it is hardly necessary to point out that inefficient illumination entails risk, strain, and ultimate damage to the sight, even apart from interference with work, or that it tends to neglect of cleanliness and adds to the risk of working in poisonous materials, or that it increases the need for artificial light, which can seldom be as satisfactory as daylight. "

Turning next to artificial lighting, it may be pointed out that we have not only to deal with the unsatisfactory conditions that arise in factories through insufficiency of light. There is room for a vast amount of educational work in teaching managers of factories to utilize their lights to the best advantage. I may mention that in the legislation of Holland on this point, as summarized in the valuable report of the Conseil d'Hygiène de la Seine in 1907, it is recommended that women and young persons should not be engaged in any occupation liable to be unhealthy or dangerous in premises which require artificial light between 9 A.M. and 3 P.M.1

The first necessity in lighting, whether natural or artificial, is that there should be sufficient light for the work. In the regulations in Holland a minimum illumination on the work of 10 lux (approx. I foot-candle) was prescribed for general work, and in certain trades recognized to be specially trying to the eyes, such as jewelry, sewing and knitting, embroidery, engraving, etc., a minimum of 15 lux (1.5 foot-candles) was specified. In Great Britain the authorities have been strongly impressed by the necessity for attempting to frame more definite rules specifying the amount of light required for various purposes, and the recent Departmental Report on Accidents in Factories and Workshops² made special refer-

¹ Illum. Eng., Lond., vol. ii., 1909, p. 319.

² Blue Book, 1911, obtainable from Wyman & Sons, London.

¹ Illum. Eng., Lond. ii., 1909, p. 373.

ence to this matter. Researches are still being carried out on this subject, but, meantime, the report contained the important recommendation that "even before such a standard can be arrived at, it is recommended that the inspectors should be given general statutory powers to require adequate lighting in all places which are a source of danger by reason of insufficient lighting."

Again, in the report of H.M. Chief Inspector of Factories in Great Britain for 1908, various examples of the results of working by insufficient light were mentioned, notably that of girls with weak sight engaged in certain textile mills. In commenting on these conditions, it is remarked: "Sometimes, however, we are met with indifference or reluctance to spend money on this condition for healthy working (i.e., sufficient illumination), and we have no statutory provision to rely upon."

It is evident, therefore, that even in this year the need for some precise standard of illumination was making itself felt. would appear that it is necessary to move with care in this matter and to collect full information regarding the amount of illumination necessary and feasible for different classes of work, and as to the best means of measurement. Any definite specification of a certain amount of illumination naturally implies that sufficiently trustworthy and convenient instruments for measurement should be available. Fortunately, considerable progress has been made during the last few years toward rendering such measurements more simple and accurate. A considerable amount of work in this direction has been done by the Illuminating Engineering Society in London in obtaining data regarding the illumination in schools, libraries, factories, etc., and the measurement of illumination is coming to be looked upon as quite a convenient and reliable process. Naturally, we may hope for still further progress to be made in the course of the next few years.

In the absence of complete information, it may be necessary in many cases to be satisfied with wide and general recommendations on illumination for the moment. But I would urge on this congress the importance of at once making preparations for the desired data to be collected in future.

It must not be assumed that the provision of sufficient light is all that is needed. It is equally essential that the light should be wisely used. One of the greatest defects to be met with in much of the factory-lighting of to-day is that the lamps are not sufficiently shaded and are too frequently placed in positions in which they dazzle the eyes and impose a distinct strain on vision. Very few of the modern illuminants are sufficiently mild in intensity to be used at close range in this way.

Another point that requires attention is that the lamps should be placed in the right position. In writing, for example, it is a continual source of inconvenience if the lamps are situated on the right hand, so that a shadow of the hand is cast just where one wishes to see the page. The light in such cases should preferably come from over the left shoulder. This defect is not an uncommon one in banks and offices. It need hardly be added that in all mechanical operations (cutting, drilling, etc.) the direction from which the light comes is very important. Also that positions of lights which result in a shadow of the head or body of the operator being cast on his work should be avoided. Yet another defect in lighting to be guarded against is the use of unsteady and flickering sources of light, which are notoriously trying to the eyes

All these defects must tend to increase the strain of employment and be prejudicial to the general health. In addition to this, there are certain occupations which are specially trying to the eyes, such as textile work, sewing, lace-making, engraving, watch-making, printing, etc., where good illumination is particularly essential. Dr. Gallenga, in a communication to the second Congrès International des Maladies Professionelles in Brussels in 1910, gave his experiences regarding the tendency to deterioration in eyesight of apprentices in printing works, and I understand that valuable work on this subject is now being done by Dr. L. Carozzi.

So far I have spoken mainly on the value of good illumination in assisting an operator in his daily work and diminishing the number of absentees through ill-

health. This is naturally a matter of considerable consequence to manufacturing concerns (the more so in Great Britain on account of the recent Workmen's Compensation Act), and likewise to insurance companies, which have to meet claims for compensation arising through ill-health traceable to bad lighting.

But there is another point that is, perhaps, equally important, namely, the value of good illumination from the point of view of safety. Those who have studied this subject are well aware of the considerable number of mishaps that arise through defective lighting. The Fidelity and Casualty Co. of New York, in a recent report, placed bad lighting first in a list of causes leading to accidents. Additional evidence is provided by a curve, which was originally published in The Journal of Industrial Hygiene, showing the percentage of accidents that occurred at various times in the year.1 Experience shows that it is in the dark winter months, when artificial light has to be largely relied upon, that mishaps mainly occur. It has also been stated that a relatively large number of accidents occur after 4 P.M., this being the time at which artificial light becomes necessary in the winter time, and that the amount of "spoiled work" during this period is exceptionally great.

Among other obvious necessities may be mentioned the illumination of dangerous machinery. It is not of much value to place a guard round a dangerous machine if the light is so poor that its outlines cannot be clearly distinguished, and many a machine that would be considered safe in a well-lighted room becomes dangerous to life and limb if allowed to run in semidarkness.

At the important Congrès International des Maladies Professionnelles, held in Brussels in 1910, a special recommendation was inserted regarding the adequate lighting of dangerous machinery. And the Departmental Committee on Accidents in Factories in Great Britain stated that inadequate lighting is a "very frequent cause of accident and of grave danger, especially in the smaller printing works and in the Midlands."2

1 Illum. Eng., Lond., vol. iv., 1911, p. 578.

It may be pointed out that a bright light placed in the full range of view at the top of a flight of stairs, or in front of some obstacle, may actually be the cause of a man stumbling, owing to his eyes being dazzled. A case is mentioned of a man who walked off a platform and was killed—on some scaffolding—owing to this very cause; even those around him did not realize that he had not solid footing until he actually fell.

Many other instances of the way in which imperfect lighting leads to accidents might be mentioned. Besides the avoidance of dazzling lights, the direction from which the light comes is often important. For example, in certain tailoring works, in which the hand is held quite close to the sharp, cutting edge of the tool, a bad shadow momentarily obscuring the tool may not only lead to spoiled work, but also to mutilation of the hand of the worker. Again, quite apart from actual personal mishaps of this kind, it is well known that badly lighted plant is apt to be neglected and allowed to become dirty, thus paving the way for an ultimate breakdown.

A special case might, no doubt, be made out for the need for good illumination in mines. It is difficult in such dark surroundings to bring up the illumination to the same order as that above ground, but the supreme importance of the matter can scarcely be doubted. Here, as elsewhere, good illumination is one of the most effective safeguards against accidents. Concern has recently been caused by the spread of a nervous affection of the eyes known as "nystagmus," on which several papers were presented at the Congrès in Brussels in 1910. According to the views of Dr. J. Court of Staveley and of the late Dr. Thompson of Cardiff, it is due largely to the defective illumination produced by miners' lamps, so that better methods of lighting may be found to prove the desired remedy. This view has been taken by Dr. Llewellyn in a recent paper presented to the Royal Society. During the last year no fewer than 1,618 men received compensation owing to their being afflicted with this malady, which is now coming to be regarded as an "industrial disease." Among the causes he places defective illumination first.

² Illum. Eng., Lond., vol. iv., 1911, p. 193.

Having thus briefly surveyed the question of the value of good lighting in factories, especially as a safeguard against accidents, I should like to conclude by a brief review of the recent important steps that have been taken to improve matters in this respect and to gain fuller information. During the last few years there have been quite a number of valuable conferences on the subject. I have already alluded to the interest taken in illumination by the Home Office in Great Britain, as exemplified in the recent reports of H.M. Chief Inspector of Factories, and the emphasis laid on good lighting by the recent Departmental Committee on Accidents.

Meantime other countries have also been active. I need not remind you of the existence in Milan of the first Institute devoted to Industrial Hygiene, under the supervision of Dr. L. Devoto, the work of which is already widely appreciated, and is destined to receive even fuller recognition in the future. I trust that Italy, which has taken this great step, will continue to be in the front in studying the industrial importance of good illumination.

Next, I should like to recall the interesting and unique Congress on Industrial Hygiene which took place in Brussels in 1910, and to which I have several times had occasion to refer in this paper. On that occasion important papers on lighting matters were read by your distinguished Secretary, Sig. F. Massarelli, Dr. F. Terrien, Dr. A. Broca, and others. and I myself had the privilege of reading a paper on "The Hygienic Aspects of Illumination." Since the date of the Congrès its distinguished President, Dr. A. Moeller, has published an article on the same subject, in which great stress is laid on the need for international cooperation in this matter.1

A great step has also been taken in the appointment, by the French Government, of a Committee on the Hygienic Aspects of Illumination, on which prominent physiologists and oculists, engineers and physicists, and inspectors of factories are represented.²

² Illum. Eng., Lond., Aug., 1911, p. 455.

It appears to me to be extremely desirable that this enterprising step on the part of the French Government should be followed in other countries. I have already made representation to this effect, and I trust that the time is not far distant when similar committees will be instituted elsewhere. In such a matter as this, international co-operation would be of immense assistance.

I must also not forget to acknowledge the valuable pioneering work in stimulating public interest in illumination which has been carried out by the Illuminating Engineering Society in the United States during the past few years. A new body, the National Association for the Conservation of Vision, has also now come into existence in that country, and will doubtless supplement the work of the Illuminating Engineering Society in an effectual manner.

In England there are several societies which have devoted much attention to industrial hygiene, but I would like to single out for special mention the Royal Society of Arts, which, for more than 150 years, has made a constant practice of encouraging investigation on problems of the day.

The Illuminating Engineering Society in London, although only formed in 1909, has already been signally successful in this direction, and I am glad to say that it includes among its members many of the greatest Continental authorities on various aspects of illumination, and is, therefore, in an exceptional position to promote international co-operation in these matters

This leads me to mention one concluding step which should prove of the very greatest importance in raising the status of illumination in the future, namely, the resolution passed at the International Electrical Congress at Turin last year, sanctioning the formation, by the Illuminating Engineering Society of London, of an International Commission on Illumination. This commission, it should be explained, is to be competent to cover the whole field of illumination. It will deal with such questions as photometry, nomenclature, symbols, the rating of illuminants, etc., but it will also have power to study more practical questions, such as the amount of illumination required in vari-

¹ XXme Siècle, Jan. 6, 1912; Illum. Eng., Lond., Feb., 1912.

ous industrial employments, the hygienic that employees are reluctant to submit to effects of the various illuminants, and in dealing with such it will naturally avail itself of the conclusions reached by the expert committees on the hygienic aspects of lighting suggested above, and should have great weight in insuring their being

carried into effect in practice.

This International Commission on Illumination will also be recruited from local committees in each country, many of the members of which might naturally also be members of the national committees on the hygienic aspects of lighting. In this way all these various agencies could work hand in hand for the improvement of illumination and assist each other. It might also be suggested that in allotting the work each country might be charged with a certain section in which it was specially interested and particularly fitted to perform. That the results collected should be sent periodically to the various committees and discussed at international conferences.

What, therefore, are the steps which may be suggested as a means of improving industrial lighting, and what parties are

likely to benefit by them?

One step I have already indicated, namely, the formation of governmental committees on the hygienic aspects of lighting in the chief countries of the world and their co-operation with a view to securing corroborative evidence where necessary, but avoiding unnecessary duplication of work.

There are several channels through which much valuable information could readily be obtained. For example, factory inspectors, as a preliminary to agreement on definite rules, might be instructed by the governments in their respective countries to take particulars of the lighting conditions in the factories visited, as well as the condition of health of the workers, in order that we may be able to trace what connection exists between these two elements. For example, in the case of trades known to be trying to the eyes, particulars of the illumination and also of the eyesight of operators might be noted. It is possible that occasionally the testing of the eyesight of workers might present some difficulties in view of the fact that it is not at present prescribed by law, or

test, fearing dismissal if their defects of vision become known. In such cases I venture to suggest that the inspector should be provided with a letter from the government authorizing him to make such investigations, and explaining that they are carried out for statistical purposes, and that the results will not be used to the detriment of employer or employee.

In reporting on the illumination, inspectors should take note of obvious defects, such as the misplacing of lamps, the use of imperfectly shaded illuminants liable to be prejudicial to vision, and the neglect of adequate lighting for dangerous machinery, etc. But, in addition, I strongly recommend that actual measurements of illumination should be made, as precise data of this kind form a most valuable supplement to personal impressions for future reference. Although not yet perfect, instruments for the measurement of illumination have been very much improved, and the Home Office in Great Britain, I am pleased to say, have accumulated a considerable amount of data of this description in various factories.

It may also be suggested that a similar record should be kept as regards accidents. This matter is of considerable importance to insurance companies, friendly societies and labor associations which are concerned with compensation cases. It may be suggested, therefore, that, when an inquiry is made into the circumstance in which an accident occurred, particulars should be taken of the general lighting conditions at the time, and, if possible, also actual measurements of the illumination made.

It will be seen that in attacking this problem co-operation is most essential. It would, for example, be to the benefit of many companies to arrange for the services of an expert in measuring illumination as well as a physiologist, to work together in tests of this kind, and the committees appointed to investigate the matter would require to be fully representative in character. It would naturally be the function of the committee in each country to make use of all the existing channels of information, and to collect the results together as well as organizing special researches.

In conclusion, it may be pointed out

that an improvement in the conditions of lighting in factories would be an all-round benefit. To insurance companies it would be advantageous, because it would diminish the risk of accidents, both personal and through fire, and mishaps to machinery. I venture to suggest that it would pay such companies to allow specially favorable rates to businesses in cases in which the illumination was up to a prescribed standard (just as is already done when the precautions against fire are exceptionally complete). The employees would indisputably benefit, seeing that they would work under pleasanter conditions and with less risk. And the employer would benefit in several ways. The cost of improving the lighting would certainly not be grudged if once it were shown beyond doubt that improved illumination led to fewer accidents.

The enlightened employer also recognizes that it is to his interest commercially to secure adequate illumination because of the improved output and quality of work. Mr. Roscoe Scott¹ has recently pointed out that in very few businesses does the cost of lighting amount to more than 5 per cent. of the wages bill (in the case of an incandescent lamp factory it was less than I per cent.), so that any small expense involved in putting the lighting on a proper basis would be very readily re-

paid by the improved work and freedom from accidents and mishaps secured as a result. An interesting illustration of this fact is afforded by the cotton industry. It appears that "summer-made" goods, in certain classes, are invariably listed at a higher price than those made during the winter, the explanation offered being that. owing to the inferior artificial light in winter, the quality of workmanship is not so good.

In concluding this paper, I feel that a special expression of thanks is due to your distinguished president of the Comité d'Organization, Sig. L. Pontiggia. I venture to hope that, as Direttore della Associazione degli Industriali d'Italia per Prevenire gli Infortuni del Lavoro he will find in this paper some suggestions of interest; and it was largely the kind encouragement and support which I received when I ventured to approach him on the subject of the work of the Illuminating Engineering Society last year, that induced me to think that a paper on the value of illumination as a means of preventing industrial accidents would be of service to this congress.

It is most fitting that Milan, in which the first institution devoted solely to industrial hygiene was established, should see the first International Congress on the Prevention of Accidents, and I feel confident that this great step forward will lead to most beneficial and important developments in the future.



¹ Electrical World, Feb. 10, 1912.

[[]Author's Note.—Since this paper was written the Home Secretary, in reply to a question in the House of Commons by Dr. A. Lynch, has intimated the intention of the British Government to appoint a Departmental Committee on the Hygienic Aspects of Illumination (see *Illum. Eng.*, June, 1912, p. 284). The Report of H. M. Inspector of Factories for 1911 also contains many references to lighting, including a special report by Mr. D. R. Wilson, occupying 38 pages and containing a most valuable and comprehensive series of tests of daylight and artificial illumination.]

Hospital Lighting

CHAPTER III.

By WILLIAM S. KILMER.

THE LOCALIZED EQUIPMENT OF THE LABORATORY.

Undoubtedly the most difficult lighting problem to solve in the laboratory is the illumination of the microscopical field. The principal points for first consideration are:

First. The illumination in the field



FIG. I .- ILLUSTRATION OF MICROSCOPIC LAMP.

must approximate daylight and be evenly distributed.

Second. The source should be portable and out of the line of vision.

Many makeshift equipments have been devised which partially approach the solution of this problem, but they can hardly be classed as a unit of equipment to the laboratory. Fig. 1 illustrates a microscopic reflector in use in many hospitals. The details of construction are shown in Fig. 2. It will be noted that the instrument is portable and adjustable to any angle necessary to direct the light over the microscopical field. A 60-watt all

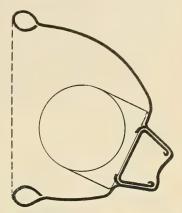


FIG. 3.—SECTION OF CASE REFLECTOR.

frosted tungsten lamp is recommended for use with this instrument for best results. The rays from this source are then



FIG. 4.—ILLUSTRATION OF THERAPEUTIC RE-FLECTOR OR FIXTURE.

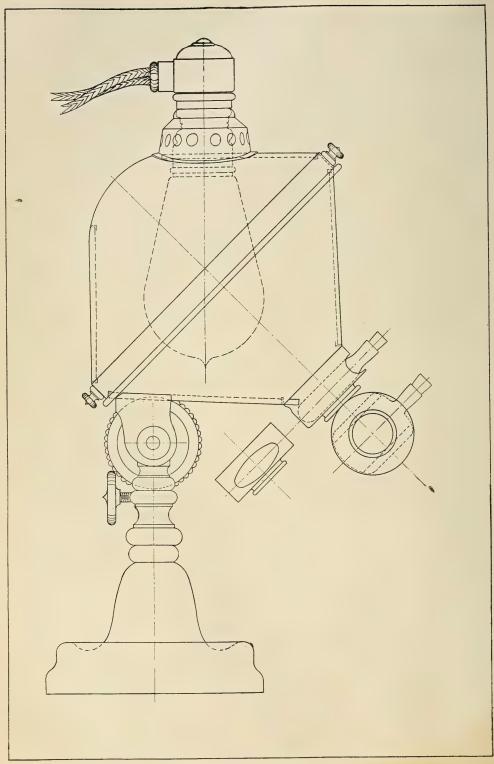


FIG. 2.—DETAIL OF MICROSCOPIC LAMP.

directed toward and through the aperture containing the liquid lens of alkali blau No. 6 diluted one part in ²⁶/₁₀₀₀ parts. The direction of the rays is accomplished by a double convex reflecting surface, the lower portion being an angular arrangement of mirrors, and the upper of opal glass.

Experiments so far with a glass slide to replace the liquid lens have not been satisfactory, dependable or consistent, owing to the variation of density and color of the glass, while the liquid lens is easily and accurately renewed or replaced, and the results obtained in pathological work render the identification of bacteria under the rays of this instrument as accurate as with natural daylight.

A requirement often overlooked, but by no means the least important, is the illumination of cabinets and cases containing instruments, dressings, etc. An immediate and correct selection is usually required, which cannot be accomplished by means of the illumination received from other portions of the room. Fig. 3 shows section of a fixture designed for this purpose, utilizing the linolite lamp. The parabolic contour of the reflecting surface and the parallel filament of the lamp direct the light rays evenly to all portions of the case with only a slight increase in temperature.

Although a therapeutic fixture can hardly be classed with the equipment of a laboratory, a few suggestions are not out of place. Fig. 4 shows an equipment consisting of a 13-inch concentrating reflector mounted on a portable adjustable standard, and meets the demand for a therapeutic lamp of sufficient intensity to be effective without the use of an extremely high candlepower source of light. A 100-candlepower stereopticon lamp is recommended, with the filament so arranged as to give practically a point source of light at the focus of the re-The results are so intense as to set paper on fire in a very short space of time if placed in the focal area.

Illuminating the Tennis Court

H. T. SPAULDING.

Before the advent of the modern illuminating engineer and the application of scientific methods to the problems at hand, attempts toward the artificial lighting of areas for playing baseball, tennis or roque have been generally unsatisfactory.

In the case of tennis, lighting installations have, for the most part, been but crude affairs, no careful study of the requirements having been made and therefore no very satisfactory results obtained. The view has long been held that if this problem were attacked in the right manner an installation could be designed by which this popular game could be played at night just as satisfactorily as in the day time, and without the discomforts resulting from the bright sun.

The schedule of the Lakewood Tennis Club, Lakewood, Ohio, demanded night play and accordingly the services of an illuminating engineer were solicited in designing a lighting installation that would permit a fast game of tennis by night.

The problem was first given consideration entirely from the scientific lighting standpoint and the conclusion reached that the court must be lighted from the sides. On this basis a reflector was designed which gave a satisfactory distribution and at the same time kept the lamps entirely hidden from the players. A unit of this type being impracticable because of cost, the nearest to it on the market was selected. This was a white-enameled steel 45-degree reflector.

It was decided to use twenty-four of these units, equipped with 250-watt regular Mazda lamps for each court. These were located twelve upon each side of the court, about thirteen feet above the ground and a few feet back from the side lines. It was impossible to locate poles along the sides of the court, due to liability of injury to the players, so the units were suspended from a cable supported at the center and at each end of the courts. With the co-operation of the reflector



FIG. I.—DAY VIEW.



FIG. 2.—NIGHT VIEW.

company, the reflectors were obtained complete with a special hanger so they could be strung upon the messenger cable in such a position that the maximum light would always be thrown toward the court. The units were kept from swinging by a second cable beneath, to which each reflector was attached. The electrical wires were strung overhead on cross arms on the supporting poles.

This is the installation which is shown in the illustrations herewith, a day and a night view. The system has been in

operation a number of weeks, and is giving perfect satisfaction. There is very little trouble from glare, as the lamps are located out of the ordinary line of vision, well concealed by the reflectors. Shadows are eliminated. The ball can be plainly seen to a height of seventy-five feet, and practically as fast a game can be played as in the day time. Evidence of the excellence of such a lighting installation is given by the fact that the Lakewood Club is illuminating a second court in a similar manner.

Light from the Earliest Times

An account of some lamps in the collection of Mr. J. W. Johnston (Fellow of the Society of Antiquaries of Scotland), and of a lecture recently delivered by him on this subject.

It will be recalled that some months ago reference was made in The London Illuminating Engineer to a most interesting lecture on ancient forms of lamps and illuminating apparatus delivered at Hendon by Mr. J. W. Johnston. By the great kindness of Mr. Johnston we have been favored with a copy of the manuscript of this lecture, and were also given an opportunity of inspecting and taking photographs of his unique collection of old lamps. In this article we shall describe some of these interesting relics, the information being based mainly on Mr. Johnston's lecture, supplemented by extracts from some works on these subjects which he has kindly placed at our disposal.

The study of these old relics is of engrossing interest. To the antiquary and the historical student it is a duty to preserve, while we may, the fast-disappearing traces of past ages. Few things are more remarkable than the rapidity with which old articles are replaced by sweeping modern innovations. Many old forms of oil lamps, for example, such as were in common use everywhere in the British Isles, before the introduction of paraffin and petroleum, have disappeared so completely that there are only a few specimens, in various museums and private collections, still in existence.

But these ancient methods of illumina-

tion have for us a certain technical inter-

The expert lighting engineer can learn much by studying the historical development of methods of illumination and their influence on social conditions. dealing with problems in illumination where artistic considerations are of importance such knowledge would stand him in good stead. And the ornamental design of many old forms of oil lamps and candlesticks, etc., would often furnish some valuable hints to the fixture-designer of today.

There can be no question that light has played a great part in molding methods of thought and religious observances. It formed an integral portion of the observances and ritual of the very oldest sects, and Dr. M. Gaster has shown how the worship of old Babylonian, Egyptian, and even later beliefs can be traced ultimately to the worship of the heavenly bodies. The very names of the heathen deities are those of the sun, the moon, and the planets (e.g., Ra, "the Sun," one of the chief gods of Egypt, and Jupiter, Neptune, Mars, &c., in Roman mythology).

Many superstitions are also connected with light and the observance of natural phenomena. "Jack o' Lantern," or "Will o' the Wisp"—the faint flame sometimes seen floating above marshy grounds—was supposed to lure travelers to their destruction. The light of the glow-worm and the firefly have also been

¹ Illum. Eng., Lond., May, 1912, p. 228.



FIG. I.—GROUP OF EGYPTIAN POTTERY AND BRONZE LAMPS. (36 SPECIMENS.)

(1) Red Clay Lamp, with original wick, Thebes. (2) Coptic Lamp, ornamented with Frog. Karnak. (3) Terra Cotta Lamp, five wicks, Thebes. (4) Prehistoric Red Clay Lamp, ornamented with concentric circles, pottery with similar circles dated back 4777 B. C., Thebes. (5) Red Long-Shaped Clay Lamp, ornamented, Thebes. (6) Bronze Lamp, Beni Hassan, Minieh, Upper Egypt. (7) Greek Lamp, with lug on left, Karnak. (8) Clay Lamp, peculiar shape, with lug underneath, Thebes. (6) Clay Lamp, resembling the face of god Bess, Karnak. (10) Greco-Egyptian Lamp, ornamented with the head of Serapis. (11) Clay Lamp, richly ornamented, Thebes. (12) Lamp carved out of stone, Thebes. (13) Bronze Lamp, Karnak. (14) Bronze Lamp, fine work, Karnak. (15) Clay Lamp, ornamented with face, Arabic imitation of Roman, Luxor. (16) Terra Cotta Lamp, twenty wicks, Beni Hassan, Minieh, Upper Egypt. (17) Black Stone Lamp, prehistoric, Karnak. (18) Dark Red Clay Lamp, two wicks, Karnak. (19) Terra Cotta Standard Lamp, three wicks, Karnak. (20) Blue Green Glaze Roman Pottery Lamp, Karnak. (21) Clay Incense Burner, Beni Hassan, Minieh, Upper Egypt. (22) Bronze Lamp (unfinished), no hole for wick, Beni Hassan, Minieh, Upper Egypt.

attributed to supernatural origin, and in the most remote antiquity there were "sacred fires" consisting of ignited natural gas and inflammable vapors issuing from the earth.

It is very uncertain when man first learned the art of producing fire. The fable attributes to Prometheus the stealing of the art from heaven. Virgil and Pliny, both of the first century, mention the production of fire by striking stones together and by friction with pieces of wood.

At a much later date both these methods were shown to be in common use among many savage races. Capt. Cook in 1770 witnessed and described the use of fire-sticks by the natives in eastern Australia, the process only occupying about two minutes. Similar methods are practised by people in many remote lands—in Greenland, Brazil, and probably in many other countries.

A later development of this principle was the tinder-box, in which a spark was produced by the rubbing or striking a flint with steel (an old file being often used for the purpose). The spark was caused to ignite some inflammable tinder, origin-

ally a piece of well-scorched linen being used, and later brown paper soaked in a solution of saltpeter and dried. The material, however, varied in different countries. It is most interesting to see how widespread the use of such devices became. Not only was the tinder-box known in Europe, but it was in common use in China, Japan, Thibet, and other Eastern countries, and some very elaborate and costly specimens have been preserved. Several examples of these appliances are to be seen in Fig. 2, including an early French variety coming from Canada, a horn tinder-box from Jamaica, and a pocket flint and steel from Aberdeenshire.

The evolution of matches was a very gradual process. An ingenious early contrivance consisted in the enclosure of a piece of phosphorus within a tube. The phosphorus could be brought to ignition by merely driving in a piston and compressing the air.

It was not until 1833 that phosphorus matches were made a success. Sulphur matches were used in conjunction with tinder-boxes, being ignited from the burning tinder. Another form of match, the "Promethean," was invented in 1828.

This involved a glass tube containing sulphuric acid placed within a mixture of chlorate of potash and sugar. To produce a light the end of the tube was broken off by a pair of nippers (supplied with the box), and the acid being liberated set fire to the potash and sugar, and so to the roll of paper attached. The lucifer or friction matches were first produced by John Walker, a chemist of Stockton-on-Tees, in 1827, a box of fifty being sold for half a crown, but the safety matches of to-day were not invented until 1855.

That the principle of the tinder-box is still not without value is shown by the recent Continental introduction of a de-



FIG. 2.—GROUP OF RUSHLIGHTS, "PEERMEN,"
TINDER BOXES AND STONE LAMP.

(14 SPECIMENS.)

(1) Rushclip, Ireland. (2) Rushclip, Wales. (3) Rushclip, Ireland. (4) "Peerman," Aberdeenshire, very primitive, being all wood. (5) "Peerman," Banffshire. (6) Primitive Stone Lamp, Aberdeenshire. (7) Domestic Tinder Box, flint, steel, tinder and damper. (8) Tinder Box, Canada, early French period. (9) Horn Tinder Box, Jamaica. (10) Pocket Flint and Steel, Aberdeenshire.

vice utilizing the sparks produced by rubbing the mineral cerite to ignite petrolvapor. The device is really nothing but a more perfect and scientific form of tinder-box. It furnishes an interesting example of the improvement of discarded inventions of the past. Another testimony to its convenience is provided by the tinder-box served out to British soldiers during the South African War, and invented by Edward Lovett of Croydon. This contained a glass for concentrating the rays of the sun, as well as flint, steel, and tinder. Focussing the rays of the sun by a burning-glass, in order to ignite inflammable substances, is of ancient origin, and appears to be not without merits in countries in which strong and continuous sunlight is nearly always available.

Let us now pass on from methods of

ignition to illuminants.

Some vessels believed to have been used as lamps by prehistoric men have been found in the British Isles. For example, Mr. J. Romilly Allen mentions the stone lamps of the Iron Age that have been unearthed in this country, and also the recovery of chalk cups, which apparently acted as receptacles for inflammable material, from the ancient flint mines of Brandon, Suffolk.¹

But it is to the East that we must go for the most complete records of antiquity. The ancient Egyptians, Greeks, Romans, and Hebrews all devised more or less elaborate methods of illumination, and in Mr. Johnston's collection there are several hundreds of such lamps, some of them dating from many years B.C. Such lamps were frequently made of clay or terracotta in place of the stone appliances dating from prehistoric times. In Fig. 1 is shown quite a series of such lamps, numbered and classified by Mr. Johnston. No 17 is of the simple black stone prehistoric variety. Others, coming from Karnak, Thebes, and Beni Hassan, are of pottery, in some cases with a colored glaze. In all cases the method appears to have been merely to produce a simple vessel to contain fat or oil, such as could be conveniently carried in the hand and would rest securely on a flat bottom when set down. The simplest farms only utilize a single wick, but others are more complicated, and it will be seen that No. 16, from Beni Hassan, has as many as twenty.

From a utilitarian standpoint the lamps are exceedingly primitive, and the light they gave, with the available fats or crude oils of that day, must have been exceedingly feeble. Many of these lamps date from several hundred years before Christ.

1." The Archæology of Lighting Appliances," Proceedings of the Society of Antiquaries of Scotland, vol. xxii, p. 79.

It is most interesting to observe how, for hundreds of years, the essential points in the design of these lamps remained the same, and to contrast this rate of progress with that of the last ten years—that have seen the development of the metal filament lamp, the flame arc, the high-pressure gas lamps, and other entirely new forms of illumination!

But our records do not stop short of a few hundred years B.C. The most remarkable lamp historically—shown in Fig. I—is No. 4. This is believed to go back to no less than 4777 B.C., the date of Mena, the first king of Egypt, and is proved to have existed before this time by the curious concentric circles marked upon the vessel, which are characteristic of the decorations of this early period. Yet even this lamp really presents little difference in design or efficiency from those in use even down to the fifth century A.D.

But if these early lamps show little sign of inventive ability as compared with modern illuminants, they are interesting for their æsthetic design and decoration. In many cases these early lamps have been very carefully shaped, both with a view to utility and appearance. For example, the form is such as to give maximum stability, and when no handle is provided, ingenious slots and excrescences are made on the surface so as to give a good grip. In addition to this, both the Egyptian and the later Etruscan clay lamps are often exceedingly well proportioned, and much thought has evidently been given to their embellishment. The same applies to pedestals designed to carry these lamps. Lamps often show quite distinct features, according to the use for which they are intended (those used in the home, for example, differing in shape and design from those intended for use in the temple).

A somewhat curious circumstance mentioned by Mr. R. C. Clephan, F.S.A., is that practically no lamps have been found among the Egyptian tombs. Yet the elaborate decorations in the interior of these huge catacombs could hardly have been accomplished without the aid of some tolerably efficient form of artificial illumination.



FIG. 3.—GROUP OF HANGING LAMPS. (6 SPECIMENS.)

(1) Incense Lamp, pewter and copper, with brass bell, Italy, sixteenth century. (2) Egyptian Mosque Lamp, brass, inlaid with enamel. (3) Church Lamp, brass, seven wicks. (4) Egyptian Mosque Lamp, pierced brass, with colored glass. (5) Egyptian Mosque Lamp, brass, inlaid with silver. (6) Egyptian Mosque Lamp, three lights, beautifully pierced brass. The Egyptian lamps are from Thebes, Karnak and Cairo.

In the lamps of somewhat later date more elaborate shapes and decorations came into vogue. From the study of the figures graven on the ancient Roman and Greek lamps much can be learned. In a most remarkable book, published in Paris in 1719, illustrations of a considerable number of such lamps are given.1 some cases very grotesque and fantastic shapes are adopted. For example, the handles are made in the shape of a swan's neck, or the lamps in the form of elephants, snails, and curious birds and beasts, often carved with a great deal of elaborate ingenuity. In some cases grotesque figures carry a wick issuing from an enormous mouth; or the wick is made to project from a vessel in the form of a sandal, &c. In some of the larger lamps complete historical incidents or legends such as the Fall of Troy are depicted. Sometimes, too, the lamps are consecrated to certain deities—Serapis, Mercury, Jupiter, &c., and the whole design is worked out with a symbolic expression of the presumed characteristics of the god to which it is dedicated. A very common

^{1&}quot; Terra Cotta Lamps." Proceedings of the Society of Antiquaries of Scotland, vol. v.

¹ L'Antiquité expliquée et représentée en figures, vol. MDCCXIX, by Dom Bernard de Montfaucon.

practise was also to make the lamp in the form of a cock:

"The cock that is the trumpet to the morn Doth with his lofty and shrill sounding throat Awake the God of Day."

However, the cock seems to have become rather curiously associated with the Prince of Evil. Harold Bayley says: "In England, at any rate, the cock was regarded with disfavor by the Church, as a sort of devil's messenger from his crowing after Peter's denial. Throwing at cocks with a stick was a Shrove Tuesday pastime, which was enjoyed by many divines as a pious exercise." In the early Coptic lamps, and in lamps used in Christian

churches, the cross was, of course, a common embellishment, and there were also representations of Scriptural events.

It would seem that one of the very earliest and obvious of all illuminants was the torch. This frequently consisted merely of a splinter of resinous and inflammable wood, pine being frequently used. Such torches gave a smoky and wavering light, but they were for long the recognized method of illumination. Sir Walter Scott, in "The Legend of Montrose," describes a banquet in the hall of the House of Menteith, when "behind every seat stood a gigantic Highlander . holding in his right hand his drawn sword with the point turned downwards, and in the left a blazing torch made of bog-pine."

Forms of clips to hold the kindled splinter or rush-light were in common use in remote districts until quite recent times. It will be recalled that in referring to Von Benesch's work on "Illumination in the Middle Ages," a view was given of an old smithy in Mühlviertel (Austria), in which such an adjustable clip was used. In Fig. 2 we see a selection of the apparatus of this kind in Mr. Johnston's collection, rush-clips from Ireland and Wales

and "peermen" from Scotland being shown.

The material burned was usually either splinter of fir or rush-light. Such fir splints are termed "peermen," or "puirmen" (poor men), in Scotland. The origin of the name arose from the fact that poor men, vagrants, or tramps ("gaberlunzies," as they were called) cut the splinters and turned an honest penny by selling bundles about the country at a shilling each.

The rush-light dates back to very early days, but was in quite common use until about fifty years ago. Gilbert White, in his "Natural History of Selborne"



FIG. 4.—GROUP OF CHINESE LAMPS. (6 SPECIMENS.)

(1) Chinese Sheet Iron Chair-Shaped Lamp. (2) Primitive Chinese Bamboo Lamp. (3) Chinese Bamboo Chair-Shaped Lamp, with a Canton River boat. (4 and 6) Chinese Brown Glaze Earthenware Lamps. (5) Chinese Bamboo, Chair-Shaped Lamp. Nos. 1, 2 and 5 figured in the *Proceedings* of the Society of Antiquaries of Scotland, 1887-8.

(1775), describes their manufacture in some detail. It was quite a complicated process, the rushes being successively cut, allowed to rest, in water, stripped of the peel, and laid out on the grass to bleach. When dry, they were dipped in scalding fat or grease, the careful housewife frequently using the residue from her baconpot for the purpose. In other cases coarse animal oils were used. A good rush about 2 ft. 4 in. long would burn for very nearly an hour, and it is estimated that a poor family could enjoy five and a half

¹ Illum. Eng., Lond., vol. ii, 1909, pp. 525, 600.

hours of light for about a farthing. Sometimes the burning rush was allowed to rest on the top of an old chest or other piece of furniture, and would go out automatically when the projecting portion had burned away. The edges of old furniture are often found to be burned into shallow grooves through this practice. The rush-light was the forerunner to the wax and tallow candle, and was utilized in the poor man's home long after the wax candle had become the usual means of illumination for the rich. The candle has become associated with many popular sayings: "The game is not worth the candle," "Not fit to hold a candle to-" "He burns the candle at -both ends, &c.

Before leaving torches and candles, a word or two should be said on the "linkboys," whose duty it was, within the memory of many people now living, to escort pedestrians home by torchlight on dark nights. A newspaper cutting dated May 14th, 1840, refers to "the last of the link-men," so that it must have been about that time that the profession ceased to exist.

Many of the old candlesticks and chandeliers were of most pleasing design. In the Middle Ages a chandelier containing an immense number of candles was a very usual form of gift for a rich man to make to the Church, and some of these enormous coronæ are to be seen in the cathedrals to this day. In some instances they have been converted to electric light, sometimes with rather incongrous results.

Oil lamps have also played a great part in religious worship, the finest varieties of oil being used. Here, again, the actual light yielded by the lamps was relatively insignificant, but the design was often exquisite. A series of lamps of this kind is shown in Fig. 3. The artistic effect of the brasswork will be noticed, the intricate pierced pattern on the Egyptian mosque lamps being particularly fine.

Our next illustration (Fig. 4) shows some lamps of an entirely different character, coming from China. Some of them are made of bamboo, and put together in a highly characteristic and ingenious fashion. Of special interest is the chair for supporting the lamp. This can either stand on a flat surface or hang on



FIG. 5.—COLLECTION OF CRUSIES, AND A FEW OTHER LAMPS. (69 SPECIMENS.)

(1) Iron, shell-shaped Crusie, Northern Norway, used in the fishing districts. (2) Copper Crusie, Orkney, made from copper from a wrecked ship. (3) Iron Crusie with Lid, Aberdeenshire, ornamentation, blackcock's tail, the favorite design of Scotch Crusies. (4) Sheet Iron Crusie, with four spouts, from the late King's Kraal, Benin. (5) Iron Crusie, Shetland. (6) Iron Crusie, Italy, beautifully engraved. (7) Iron Crusie, Scotch, round, unusual shape of Scotch crusie, Lanarkshire. (8 and 9) Tin Crusies, Spain. (10) Wrought Iron Crusie, Italy. (11) Sheet Iron Crusie, France, ornamentation, cock. (12) Iron Lamp, in form of Hippo-sandal. Dug out of River Orwell. (13) Iron Crusie, Germany. (14) Pierced Iron Lantern, with five bull's eyes, Kincardineshire. Similar lantern portraved in J. F. Herring's picture, "Nanny," now in Blackburn Art Gallery. (15) Temole Lantern, Japan. (16) Stable Lantern or "Bowit," Banffshire, with candle-holder. (17) Bronze Lamp, in shape of foot, with sandal, fourth century. Remainder of collection are mainly Scotch Crusies, obtained from Islay, Inverness, Aberdeen, Eanff, Kincardine and Lanarkshire.

a nail on the wall. There is also a contrivance beneath the lamp proper to catch any oil that may drip over.

We now come to the "crusie" lamps, a fine collection of which is shown in Fig. 5. The name "crusie" (cf. "cruse") is really local, being applied to this particular variety of flat metal lamp in Scotland. But it may be used to describe the

general type. These lamps, it will be seen, consist of simple shallow receptacles with spouts at intervals round their rim, from which wicks project. In Scotland they were almost invariably the work of village blacksmiths, being made of beaten iron. These crusie lamps are, however, common to almost all nations, being found even in some of the catacombs of Rome. Their essential form appears to have been retained practically unchanged for centuries, and there are specimens which are known to have been used in the same family for several hundred years. made of iron, they would be practically Specimens made of tin, unbreakable. bronze, brass, and copper, and even stone, can also be seen, and in Mr. Johnston's collection such lamps, from Holland, Norway, North Italy, and even Colombo and North Borneo, are included. It is striking to observe how exactly the characteristic form is repeated in different countries.. Presumably the types found in remote districts were based on specimens imported from Europe. It is curious, however, how each country contrived to give its impress to the design of the lamp, the ornamentation of the Scottish lamp generally taking the form of the blackcock's tail, while the specimens from Norway have the general form of a boat.

The Scottish crusie, like many of the European lamps, was provided with a lower receptacle to catch the drippings of the oil. Another device was a projecting ratchet, by which the flow of oil in the vessel could be regulated to the wick. In some cases the upper receptacle was provided with a lid. When in use the crusie was commonly hung by the iron hook at the back. The wick was usually of the rush-pith or worsted varn, and the oil was of home manufacture, extracted from fish or mutton fat, and usually very coarse and rank. In Japan oil extracted from nuts was used, and in Nigeria vegetable oil termed "Shea butter." As an illuminant the crusie was anything but ideal. It frequently gave rise to an unpleasant acrid smell, owing to lack of proper access of air to flame and incomplete combustion. It required constant trimming and attention, and the light was of a feeble and flickering character. Until the middle of the last century the crusie was in general use in Scotland, when it was eventually superseded by the paraffin lamp.

Several other items in Fig. 5 call for mention. No. 15 is an interesting lantern from a temple in Japan, No. 14 a pierced iron lantern with five bull's-eyes from



FIG. 6.—COLLECTION OF BRASS LAMPS AND TINDER BOXES. (52 SPECIMENS.)

(1, 2, 3, 4, 5) Figure in Plate III. (6 and 7) Brass Hanging Lamps, Japan, Pith of Rush used as wicks. (8) Brass Crusie Lamp, Colombo. (9) Brass Crusie Lamp, Holland. (10) Brass Crusie Lamp, beautifully engraved, Morocco. (11) Brass Chanukah Lamp, nine lights, from Jewish Tabernacle. (12) Brass Candle Lamp, pierced and engraved, Jaipur, India. (13) Brass Figure Standard Lamp, Italy. (14) Etruscan Lamp, bronze, column with serpent entwined, standing on three cloven hoofs, period 300 B. C., found in Thebes. (15) Brass Lamp, three wicks, on iron standard, Syria. (16) Brass Standard Lamp, two wicks, Portugal. (17) Brass Butterfly Candle Holder, Seoul, Corea. (18) Small Brass Table Lamp, Japan. (19) Brass Tinder Boxes. Holland. (20) Brass Pricket Candlestick, Japan. Others figured represent specimens from Venice, Rio Tinto, Malta, Jerusalem, Bruges, etc.

Scotland. There is also an example of the fantastic form of bronze lamp, in the form of a sandal similar to those described in the old work by Dom Bernard de Montfaucon in 1719. The stable lantern, or "bowat," comes from Banff. One of the most interesting in existence is the original lantern of Guido Faux, now in the Bodleian Museum at Oxford.

The last illustration shows a miscellaneous collection of brass lamps, many of them crusies from various countries. A particularly elegant piece of work is the Etruscan lamp No. 14, and No. 11, the nine-light "Chanukah" lamp, has an interesting significance in view of its association with the Hebrew Chanukah festival to celebrate the deliverance from Syria under Judas Maccabæus. In these ceremonies the kindling of lamps forms an important part of the ritual.

There is doubtless much to be learned from the beautiful proportions and ingenious devices met with in many of these old lamps. The lighting engineer of to-day, who is so often occupied in the problem of introducing new illuminants amid old surroundings, would often find it of benefit to bear in mind the influence of tradition, and to imitate some of the graceful lines of appropriate ancient fixtures. Our present illuminants, considered from the purely utilitarian standpoint, are doubtless far more efficient. But it may be questioned whether they receive the same deliberate care from the artistic standpoint as was lavished even on the simplest forms of lamps in the past.

In conclusion, we must express our great appreciation of Mr. Johnston's kindness in granting facilities for the writing of this article, and we have also to acknowledge the assistance of Mr. Val. H. Mackinney, to whose skill the excellent photographs of the collection are due.

IT is the future issues of GOOD LIGHTING that will express our conceptions and warrant your pleasure. The Present issue, the starter, is but the result of a most hasty effort. THE EDITOR.

High-pressure Gas Lighting at Victoria Station London



The accompanying photograph was taken by Mr. V. H. Mackinney during the investigations on railway lighting described at a meeting of the Illuminating Engineering Society (London) in December last.

The photograph was taken under considerable difficulties. The platform was occupied by piles of luggage and crowds of moving people, which naturally tends to give the floor a somewhat dark and blurred appearance. (It is curious to notice that among all the distributed luggage one single bag apparently remained untouched during the exposure, and has, therefore, appeared in the photograph.) The difficulty of securing the correct exposure was accentuated by the fact of the surroundings being so dark in comparison with the lights. Measurements showed that the surface-brightness of the roof girders was only about 0.05 footcandle; the clock, on the other hand, was about 5 foot-candles; while the lamps themselves may be regarded, for photographic purposes, as over 1000.

Some reference to the conditions of illumination in the station was given at the meeting of the Illuminating Engineering Society by Mr. J. G. Clark. Inverted high-pressure lamps (56 in.) are now employed. It is interesting to note that, when the change was made from upright to inverted burners some years ago, it was found that a saving of 40-50 per cent. of gas had been made, while the illumination was maintained at practically the same figure as before. At the present time the minimum illumination on the platforms thus lighted is about 0.2-0.25 foot-candle, thus agreeing very well with the desirable minimum suggested by Mr. Haydn T. Harrison for well-lighted main stations.



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THOMAS ALVA EDISON.

An Interesting Anniversary

Wednesday, September 4, was the thirtieth anniversary of the beginning of commercial incandescent lighting, for in 1882 Thomas A. Edison placed in operation in New York the world's pioneer central station.

From a single generator of 125 horse-power, in an old brick building in lower Pearl street, current was sent through a system of underground cables to some four hundred lamps in a territory of less than a square mile. And with only two interruptions, whose aggregate time is less than twelve hours, the service that was begun on that day, has continued until it now convers a territory extending from the Battery to Yonkers, includes about thirteen hundred miles of underground transmission lines and

feeders, supplies 129,000 customers while in contrast with the four hundred lamps of the first day there is now the equivalent of eleven million lamps.

Instead of the old brick building, that housed the generating apparatus, there are now two Bastile-like structures that cover two city blocks, while thirty-one sub-stations are required to convert the high tension transmission voltage to the low voltage for distribution; and the historic "Jumbo" of but 125 horsepower has yielded ground through a long line of descendents to a steam turbine of thirty thousand horsepower.

The Edison Company of to-day is the successor of the company that under the personal direction of Thomas Alva Edison established the world's first permanent

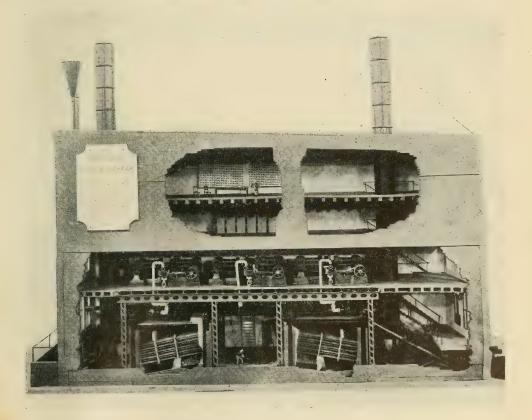


FIG I .- MODEL OF HISTORIC EDISON STATION.

central station in a large city. Organized in December 1880, it was known as the Edison Electric Illuminating Company and was the licensee of the Edison Electric Light Company which held Edison's electric light patents. Two years of preliminary work saw the establishment of a steam generating station, the extension of a distribution system of some fifteen miles and the installation of about 400 incandescent lamps. Thirty years of commercial growth has seen this system become one of thirteen hundred miles of cable, 360 of which are of the high tension transmission system, while from the 400 incandescent lamps the number has become about five and a quarter million, the connected load equaling 714,000 horsepower.

Steam boilers were installed in the basement of the reconstructed building at 257 Pearl street and the generating units were set up on the second floor. These were the now historical "Jumbos" the first type of commercial generating machines in the world. They were six in number, and each was driven by an engine of 125 horsepower. Prior to those for the Pearl street station, generators of a similar type had been constructed in Edison's Goerck Street manufacturing plant and shipped to London and Paris.

During the summer of this same year the underground distribution system was planned and laid out, and the wiring was installed in the buildings of prospective customers. The wiring of these buildings, the laying of the street mains, and the installation of the generating apparatus was all done under the personal supervision of Mr. Edison.

At three o'clock on the afternoon of September 4th, the current generated by one of these sturdy Jumbos was turned into the mains and to the buildings of the "first customers." The following observation from one of New York's most influential papers pictures the scene: "The Edison central station was yesterday one of the busiest places down-town and Mr. Edison was by far the busiest man in the station. The giant dynamos were started at three o'clock in the afternoon and according to Mr. Edison they will go on forever unless stopped by an earthquake."

This station and the six Jumbos con-

tinued operations until January 2, 1890 when fire destroyed the building. one dynamo, No. 6, was saved, and that only because it was near a window, and firemen playing their hose from the elevated structure were able to confine the flames to the rear of the floor. That fire put the lighting system out of business for less than half a day, because the Liberty street annex, opened in 1887, was able to take up the load and by placing certain restrictions on the use of current. carry the burden until new machinery could be installed at Pearl street. 1890 another annex to the Pearl street station was opened in the Produce Exchange Building.

In the meantime the new Duane-Pearl street station, the fourth that had been built to meet the increasing demands for electric light had been completed, and in 1895, the old station outgrown and out of date was dismantled and sold. Old No. 6, having yielded to machines of greater power and more modern design, was placed on the pension roll and is now treasured by the New York Edison Company as a relic of the early days of

the lighting industry.

With the exception of this and one other interruption, aggregating together less than twelve hours, Edison service has been continuous in New York since the day the first dynamo was started—a remarkable fulfillment of the inventor's prophecy that the service would go on forever unless stopped by an earthquake.

The original Edison plan called for the generation of current at as many as thirty-six independent stations south of Fifty-ninth street, each with its own steam boiler equipment. However through the use of the high tension system of transmission which began on November 3, 1898, it bmecame possible to concentrate all the generating apparatus at one locality, and to operate at various parts of the city, not the steam generating plants that had first been planned, but sub-stations, all connected with the central station by high tension feeders.

The waterside stations of the New York Edison Company built in 1900 and 1905 are the result of the concentration made possible by the system of high tension alternating current transmission.



FIG. 2.—WATERSIDE STATION FROM RIVER.

The largest generating stations in the world, they occupy two city blocks on the East River front and have a capacity of approximately 700,000 horsepower. Through some thirteen hundred miles of cable, which connect the 31 sub-stations with Waterside and interconnect the substations each with the other, current is now supplied in New York. Five million two hundred and forty-five thousand incandescent lamps are lighted, there are 40,400 arc lights on the system and 337,-200 horsepower in motors while 159,000 meters are required to measure the current. The Edison system covers practically the entire island of Manhattan with its 21.93 square miles and the Bronx which contains some forty square miles.

Although the Edison Electric Illuminating Company of the "80's" was the first organized company to do commercial electric lighting, and the Pearl street plant was the first central station in the world, there were earlier instances of incandescent lighting, all based on the inventions of Mr. Edison. In fact at his own home in Menlo Park he had laid out an underground system supplying more than four hundred lamps; and in 1879 a lighting system had been installed on the steamship Columbia, while less than a month prior to the opening of the Pearl street station a small generator of a different type had been placed in operation at Appleton, Wisconsin, where a waterfall supplied the power.

TECHNICAL

The Determination of Color in Artificial Illuminants

By Dr. W. Voege.

After reading the paper by Mr. T. E. Ritchie on "Color Discrimination by Artificial Light," it occurred to me that an account of a method devised by me for studying the color of artificial illuminants would be of interest. This method enables the small differences in the color of the light from two sources to be very easily determined and expressed.

The method employed by Mr. Ritchie was to illuminate a series of colored materials by artificial light and daylight and to photograph them on a plate, the sensitiveness of which throughout the spectrum approached very closely to that of the human eye. Now, while this process may serve as a means of judging illumination, I venture to suggest that it is not well adapted as a means of testing the color effects of various sources, and for the following reasons:

I. The sensitiveness of a Wratten plate with K3 filter is appreciably less than that of the eye in the green, between $520\mu\mu$ and $560\mu\mu$, and, moreover, the relative sensitiveness to different colors is to some degree dependent on the time of exposure.

2. It is at present difficult to define and reproduce a series of colored samples with sufficient exactitude (e. g., the terms used to define various tints are distinctly uncertain).

3. Results obtained by the aid of photographic plates are only with difficulty resentable numerically and in graphical form.

For all these reasons it seems to be preferable to determine the spectrum composition of the lights and to draw conclusions therefrom as a result of actual experience with colored materials and illuminated objects. Such spectrum analysis can be carried out with the spectro-photometer. But the method is ordinarily too complicated for practise, and presents great difficulties in the case of spectra which are broken up into individual lines. In this case a widely opened slit must be used, so as to secure a larger illuminated area. It is also somewhat questionable how far the results of different observers can be compared one with another.

The problem is considerably simplified if one works with colored glasses, and selects them so as to separate out a series of adjacent regions in the spectrum, the intensity of which can be determined in the usual way. I published some researches based on this method in 1905,¹ but considerable progress has been made meanwhile, and the applications of such methods to so-called "daylight-lamps" are of interest.

Instead of placing a colored glass in front of each lamp, I now use small monochromatic glasses about 20 mm. in diameter, which are inserted in front of the eye-piece in the photometer so that the observer sees the image of the photometric field through them. Such glasses are made by Schott & Gen with a known transparency. By using these glasses alone, or in suitable combinations, the ranges in the spectrum shown in Fig. 1 can be secured. As it is not at present possible to produce a pure yellow glass, I utilize the glass No. 433 III., which, by transmitted light, appears yellow-green.

¹ Illum. Eng., Lond., Feb., 1912, p. 64.

¹ Jour. f. Gasbeleuchtung und Wasserversorgung, 1905, p. 513.

The color comparison between two lamps is now very easily accomplished by a simple photometric test, using successively the red, green, yellow and blue glasses. We thus obtain certain relative

or a similar instrument. In the Schmidt & Haensch instrument the equality of brightness of the photometric surfaces is adjusted by means of a rotating sector, both the sources of light meantime being

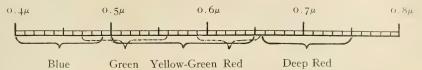


Fig. 1.—Showing the various ranges in the spectrum secured by the use of colored glasses.

figures, which are reduced to a common value in the yellow-green.

For the "comparison lamp" in these investigations it is desirable to select a

stationary. In order to adapt the instrument for the color measurements the standard lamp at O (a small metallic filament lamp) is removed. Instead of it, a

TABLE I.

GIVING PARTICULARS OF COLORED GLASS SCREENS USED.

Color of Glass Used	Material No.	Range of Spectrum Transmitted	Wave Length of Max. Intensity
Blue Green. Yellow-green. Red Deep red	433 III. 2745	$\lambda = 0.40 - 0.47$ $\lambda = 0.47 - 0.56$ $\lambda = 0.5 - 0.65$ $\lambda = 0.59 - 0.65$ $\lambda = 0.66 - 0.75$	$\lambda = 0.44 \lambda = 0.53 \lambda = 0.56 \lambda = 0.64 \lambda = 0.72$

lamp of high candle-power. All the colors should be well represented, and the intensity throughout the spectrum as uniformly distributed as possible. A Hefner lamp is not satisfactory for this purpose. Acetylene is preferable, but it is difficult to secure a sufficiently constant light, and a metallic filament or Nernst lamp of 50-100 H.K. gives the best result.

The measurements can be carried out on an ordinary photometric bench, but it is necessary to place the lamp tested at a convenient distance from the photometer and only move the comparison lamp. When using these obscuring glasses it is only in this way that one can get enough light. If one were to keep the lamps stationary, and move the photometer to and fro, it would often be necessary to bring the instrument so near to one of the lamps that the inverse square law would not apply.

It is better still to utilize a "Universal Photometer" of the type shown in Fig. 2,

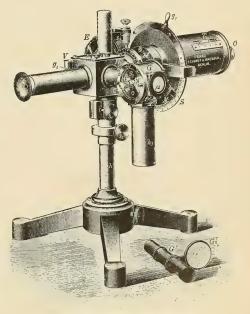


FIG. 2.—UNIVERSAL PHOTOMETER.

Nernst lamp at a distance of 5-8 cm. is substituted in front of the milky glass screen, the other screen being illuminated by the lamp to be tested. The adjustment of the light is carried out by means of the sector S, and the image of the photometric surface is observed through the aperture A, where the colored glasses are placed, and the distance of the lamps from the instrument can be adjusted until the illumination, as seen through the particular glass employed, has a convenient in-The exactitude with which the measurements can be carried out is considerable, as is shown by the figures in Table II., representing the results of three series of observations comparing a Nernst and a 100 c.-p. carbon filament lamp.

Even in the blue, where the light given by these lamps is exceedingly small, the average difference does not exceed 3 per 6. Acetylene lamp (30 H.K.).

7. Arc lamp, ordinary carbons (8 amps.).

8. Bremer arc lamp (8 amps.).

9. "Carbon" arc lamp (10 amps.).

10. Flame arc lamps:

(a) with white-burning carbons (Siemens).

(b) with yellow-burning carbons (Siemens).

(c) with red-burning carbons (Siemens).

11. Daylight lamp (Körting & Mathiesen, 8 amps.).

12. Mercury vapor lamp (55 volts 3.5 amps.).

13. Mercury vapor lamp (35 volts 3.5 amps.), with rhodamine reflector.

14. Mercury vapor quartz tube lamp (220 volts).

The results of these tests are summar-

TABLE II.

SHOWING AGREEMENT BETWEEN THREE SEPARATE EXPERIMENTS COMPARING NERNST AND CARBON FILAMENT LAMPS.

	Values Obtained				Max. Deviation
Color	(1)	(2)	(3)	Mean	from Mean
Yellow-green. Green. Blue. Red. Deep red.	65.3 62.5 49.6 72.4 76.5	64.5 63.5 52.5 71.0 77.0	65.5 62.0 51.0 72.0 73.5	65.1 62.7 51.0 71.8 75.7	0.92% 1.27% 2.94% 0.83% 1.72%

cent. As an illustration of the sensitiveness of the method, it may be mentioned that the difference in color in the light given by two petroleum lamps using distinct types of burners or different varieties of petroleum can be determined with confidence.

By this method (see Table III.) I have studied the following illuminants:

- 1. Daylight from a white, cloudy sky.
- 2. Tantalum 110-volt 25 H.K. lamp. Tungsten 110-volt 25 H.K. lamp.
- 3. Nernst lamp (80 H.K.)
- 4. Petroleum lamp, "Reform" round burner (12 H.K.).
- 5. Petroleum lamp, "Adonis" burner (28 H.K.).

ized in Table III., the values for daylight from the clouded sky being taken as unity. For the sake of comparison the values determined spectro-photometrically by Frl. E. Köttgen for the blue sky and direct sunlight are also included in the above table.

Taking, first, the illuminants which depend almost entirely on the incandescence of solid particles, one finds that the approximation to daylight is a matter of temperature. The higher the degree of incandescence the greater the accentuation of the green-blue end of the spectrum at the expense of the red. They can be arranged in the following order: Hefner, petroleum, carbon filament lamp, tanta-

Lamp.	Mer- cury Quartz Lamp	0.58	0.78	I.00	0.04	10	
Mercury Vapor Lamp.	Ordinary Lamp with Rhoda- mine Reflector	0.97	08.0	I.00	0.62	0	
Tercury	Ordi- nary Lamp with Glass Tube	0.77	0.88	I.00	10	10	
	"Day- light" In- closed Lamp	1.18	1.18	I.00	0.40	0.54	
اند	White Flame Car- bons	I.05	1.21	1.00	76.0	*	
Electric Arclight.	Red Flame Car- bons	0.45	06.0	I.00	I.68	*	
Electric	Yellow Flame Car- bons	0.24	0.75	1.00	1.16	*	
	Bremer Lamp	0.07	0.67	I.00	1.90	0.87	neasure.
	Ordi- nary Car- bons	0.75	0.97	1.00	I.35	I.70	Too small to measure.
	Hefner	0.00	0.73	I.00	2.24	3.9	† Too s
	Incan- descent Gas- light	0.23	0.80	I.00	1,20	I.13	
(Acety- lene	0.27	98.0	I.00	I.37	*	d.
Petroleum.	"Adon- is" Burner	0.15	0.79	I.00	2.12	3.26	* Measurement omitted
Pet	Tung- sten) Nernst form" Lamp Lamp Burner	0.12	0.74	I,00	2.18	3.87	asureme
	Nernst	0.24	0.84	I.00	1.58	2.14	* We
owlamp	Tung- ksten y Lamp	0.23	0.86	I.00	1.63	2.10	
Electric Glowlamp.	Tanta- lum Lamp	0.21	0.79	I.00	1.63	2.14	
Ē	Carbon Fila- ment Lamp	0.20	0.79	I.00	I.76	2.70	
	Sun- light	0.65	0.85	I.00	06.0	08.0	
light.	Blue	1.65	I.33	I.00	0.77	0.65	
Daylight.	Cloudy	I.00	I.00	I.00	I.00	I.00	
	Color	Blue	Green	Yellow- Green	Red	Deep Red	

TABLE III.—Containing Comparison of Colors of Various Artificial Illuminants.

Daylight.

lum lamp, tungsten lamp, Nernst lamp, acetylene, arc light, sun.

The incandescent mantle is not to be considered as depending on pure temperature radiation alone; while containing approximately the same amount of blue and green as the tungsten lamp, it yet contains considerably less red. A pronounced, discontinuous spectrum is yielded by the Bremer and the flame arc, and by the mer-

cury vapor lamps.

The effect of the higher temperature of the quartz tube mercury lamp, as compared with the mercury lamp having a glass tube, is clearly distinguishable, and the action of the rhodamine reflector is quite striking, although, naturally, not unaccompanied by loss. For example, when a white reflector was used, the illumination at a certain distance was 240 lux, but this was diminished to 165 lux when a fluorescing reflector was substituted. This reduction of 30 per cent. is attributable mainly to the fact that the green rays have a higher luminous efficiency to the eye than the red. The loss of light is, however, counterbalanced by the improvement in the color of the light.

It is interesting to observe from these figures how widely the individual sources of light differ from daylight. Daylight lamps give, on the whole, a good agreement with daylight (which is itself subject to considerable fluctuations, according to climatic conditions). In such lamps an enclosed arc is screened with suitable absorption glasses. The resultant light approached daylight very closely in the blue and green; but, in contrast to most artificial illuminants, there is a deficiency of red. This deficiency might be made good by a combination with carbon The resemblance of filament lamps. flame arc with white carbons is remarkably close, but, owing to the fumes given out by carbons of this kind, it is not considered desirable to use them in small interiors.

It may be noted that, although the color of the mercury vapor lamp is substantially improved by the addition of the rhodamine reflector, there are still rays in the extreme red which are altogether lacking.

Table IV, illustrates the effect on the

color of the light of frosted and opal glass globes.

The method described, which has shown itself very serviceable in examining and comparing the color of the light from different illuminants, can also be applied to colored materials. In comparing such

the lamp used. But we are only concerned with the relation of the figures to one another, which can be easily presented by reducing all the figures, taking one color (e. g., the yellow-green) as unity. The table enables us to see what kinds of light are most strongly reflected by the different

TABLE IV.

Effect of Frosted and Opal Globes on Color of Light.

	Electric G	low Lamp	Nernst Lamp		
Color	Clear Glass	Frosted Glass	Without Globe	With Opal Globe	
Blue Green Yellow-green Red	I.00 I.00 I.00 I.00	0.77 0.97 I.00 I.24	I.00 I.00 I.00 I.00	0.84 0.89 1.00 0.95	

samples, they are successively illuminated by the same lamp, and the reflected light from them passes on to the photometer screen. For example, in my researches I found it convenient to illuminate the colored materials by a powerful projection materials. It will be observed that in general colored fabrics reflect some light from most parts of the spectrum; for example, a sample which appears yellow to the eye also contains a very considerable proportion of green, red, and even blue light. By

TABLE V.
Tests on Colored Materials.

Color	Colored Paper Tested					
	Violet	Blue	Green	Yellow	Bright red	Deep red
Blue	69 18 28 64 74·5	61 8 4.5 4.8	15 22 14 3·5 20	15 70 81 83 83.5	5 20 22 75 83	1.8 2.0 6.2 46.5 68

Nernst lamp, while a 60 H. K. Nernst lamp serves as the comparison unit. The photometric comparison was then carried out through the colored glasses in the usual way.

The absolute magnitude of these values is naturally dependent on the intensity of

using different illuminants different results would, of course, be obtained. Investigations into the effect of colored materials defined in this way, by means of the method adopted by Mr. Ritchie, would doubtless yield results which would be most interesting.

CONVENTION

Illuminating Engineering Society, Niagara Falls Hotel Clifton, Ont.

SEPTEMBER 16 to 19, 1912

PROGRAMME

1. Addresses of Welcome, by Mr. O. E. Dores, president of Board of Trade, Niagara Falls, Ont., and Mr. G. F. Nye, president of Board of Trade, Niagara Falls, N. Y.

2. Response to Address of Welcome.

3. Presidential Address, by Mr. V. R.

Lansingh.

4. Report of Committee on Progress. This report will deal with the recent progress and developments in the lighting industry both in this country and abroad.

5. A Report of the Committee on Nomenclature and Standards, which will deal with certain definitions and terminol-

ogy of illuminating engineering.

6. "Steel Mill Lighting"—a report of the Committee on Illumination of the Association of Iron and Steel Electrical Engineers-to be presented by the chairman, Mr. C. J. Mundo.

7. "High Pressure Gas Lighting," by Mr. F. W. Goodenough, chairman of Council, Illuminating Engineering So-

ciety, London, Eng.

8. "The Status of High Pressure Gas Lighting," by Mr. George S. Barrows. This paper will be a collation of domestic and foreign correspondence pertaining to high pressure gas lighting.

9. "Recent Developments

Lighting," by Mr. R. F. Pierce.

10. "Indirect and Semi-Indirect Illu-

mination." by Mr. T. W. Rolph.

11. "Recent Developments in Series Street Lighting," by Dr. C. P. Steinmetz.

12. "Research Methods," by Dr. E. P.

Hyde.

13. "The Problem of Heterochromatic

Photometry and a Rational Standard of Light," by Dr. H. E. Ives.
14. "Reflection from Colored Sur-

faces," by Mr. Claude W. Jordan. 15. "Diffuse Reflection," by Dr. P. G.

Nutting.

16. "A Study of Natural and Artificial Light Distribution in Interiors," by Mr. M. Luckiesh.

17. "The Physiology of Vision," by

Dr. T. A. Woodruff.

18. "The Light of Small Stores," by Messrs. Clarence L. Law and A. L. Pow-

19. "The efficiency of the Eye Under Different Systems of Illumination," by Dr. C. E. Ferree. This paper will be a report of a research carried on for the American Medical Association.

20. "A Proposed Method of Determining the Diffusion of Translucent

Media," by Mr. E. L. Elliott.

21. "The Determination of Illumination Efficiency," by Mr. E. L. Elliott.

22. "An Absolute Reflectometer," by

Dr. P. G. Nutting.

23. "Color Values of Illuminated Surfaces," by Mr. Bassett Jones, Jr. This subject will be presented in the form of a series of experimental demonstrations.

24. One session will be arranged for, a potpourri, at which discussions will be in order on miscellaneous phases of illuminating engineering. It is expected that this session will bring out interesting and valuable points not particularly covered by the above papers and reports.

Reduced railroad fares will be available

for delegates.

EDITORIAL

GLARE

The defining of this too generally apparent, disturbing and destructive condition seems to be a difficult matter.

However, after all, we are more concerned in its *elimination* than in its definition.

Glare, resulting from the use of glazed (calendered) papers, is much too prevalent—of this there is no doubt.

Observe the character of the paper used in this issue of GOOD LIGHTING—and the lack of glare.

The effect is more agreeable to the eye.

The Color of Artificial Illuminants

The method of examining the color of artificial illuminants described by Dr. W. Voege in this number has the merit of

simplicity.

The spectro-photometric comparison of sources has the approval of Dr. Mees, Dr. Ives, and other authorities. It would seem that to reproduce side by side the spectra of the two illuminants to be studied, and to compare their intensity color by color throughout the visible range, would be one of the most accurate methods of analyzing the color of illuminants and comparing them with daylight. On the other hand, the spectro-photometer is an elaborate and relatively expensive form of apparatus and needs skillful handling. It is also occasionally not very easily applied to the analysis of colored materials owing to the fact that the amount of light reflected there from some shades is so small.

Dr. Voege has, therefore, adopted a somewhat simpler device. This consists in merely making an ordinary photometric comparison, but observing the field in the photometer through a series of colored glasses corresponding with the various regions of the spectrum. Presumably one cannot divide up the spectrum so exactly in this way—it is, for example, notoriously difficult to make a screen which will transmit only the yellow-and the results might therefore only apply to a particular set of glasses. But it is suggested that an approximate idea can readily be gained as to the degree of resemblance of artificial illuminants to daylight. and Dr. Voege has tabulated an unusually complete series of results obtained by this means. Generally speaking, the conclusions bear out those of previous investiga-The majority of artificial illuminants differ from daylight in having an excess of red and a deficiency in blue.

The method is apparently most readily applied in the case of illuminants giving a continuous spectrum. One would imagine that in the case of lamps yielding vivid line spectra somewhat inconsistent results might be obtained, especially with so-called blue or green glasses having a somewhat ill-defined range of transmission. The same remarks might, perhaps, apply to tests of absorption and reflection. for the presence of a peculiar band in the spectrum has sometimes a very marked influence on the general color of the transmitted or reflected light.

Lamps from the Earliest Times

By the courtesy of Mr. J. W. Johnston we are able to give in this number some particulars of his interesting collection of old lamps.

In the present day, when lamps are turned out by the hundreds and thousands in our factories, we are apt to lose sight entirely of the decorative and artistic elements. Our illuminants are incomparably more efficient as producers of light than those of past ages. But they are designed with little reference to artistic considerations, and are not infrequently used in surroundings for which they are not æsthetically suited. It may also be observed that the lamp of to-day is a very much more complex device than that of the ancients. It comprises the actual light-producing element, the apparatus for screening and distributing the light, and the means of support. Naturally the scope for scientific and artistic design is correspondingly greater.

We have lately been so occupied in the business of producing cheap and efficient illuminants that their purely utilitarian advantages have received almost exclusive attention. There are on every side practical problems in connection with the lighting of schools, offices, factories, etc., which demand the greater part of our attention, and that question of satisfying the hygienic requirements of lighting in such cases is doubtless the more pressing. Nevertheless distinct progress in the æsthetics of lighting has recently been made and the demand for artistic skill is growing. We understand that the services of artists are being used to a much greater extent in connection with fixture design. Yet there are also awaiting us great possibilities in connection with the artistic use of light which have hardly been realized as yet. In dealing with such problems it is well to have a knowledge of the methods of illumination of the past ages.

PUBLICATIONS

A Primer on Lighting

Light: Its Use and Misuse.

- ¶ We are informed that an illustrated Primer, bearing the above-given title, will be published about September 7 by the Illuminating Engineering Society.
- ¶ We have reason to feel that in many respects this publication will be both unique and remarkable.
- ¶ Advices are that within the short space of its twenty-two pages a surprising amount of interesting and valuable information is compressed.
- ¶ That illustrations contained will be very striking and tell in a way which written matter cannot how light and illumination may be used and misused.
- ¶ It is reported that the Primer does not treat particularly of any one artificial light-source; it being confined rather to a simple and non-technical exposition of those fundamental principles that are generally applicable to all forms of lighting, be the source what it may.
- ¶ Having been prepared by a committee of engineers prominent in illuminating engineering circles, and bearing the approval of the Illuminating Engineering Society, this little publication should find favor with those who are interested in spreading the gospel of good lighting.
- ¶ We are advised that the Illuminating Engineering Society will distribute a sample edition of this Primer free, and that other editions will be supplied at cost to those desiring them.
- ¶ It is also stated that any organization wishing to distribute the Primer may, without obligation, obtain permission to reprint it upon application to the Illuminating Engineering Society, 29 West Thirty-ninth Street, New York.

CORRESPONDENCE

TO THE EDITOR:

The following letter, sent April 10, reached the general offices of the Illuminating Engineering Society a day in advance of the April meeting of the Council; was copied and sent to the members of the Council some ten days later; was slated for consideration at the May meeting of the Council, but was passed over on account of lack of time, and finally came up for consideration at the June meeting of the Council:

Preston S. Millar, Esq., Gen. Sec., Illuminating Engineering Society, 29 West Thirty-ninth Street, New York City, New York:

DEAR SIR.—This communication is transmitted for consideration of the Council of the Illuminating Engineering Society; it treats, in part, with some of the views of the writer regarding the name of the society.

The name of the Illuminating Engineering Society is a misnomer. It does not reflect a consideration of light—both natural and artificial—in all its aspects, although it may reflect the attitude of the society toward the subject.

In the first place, the word "illumination" should not play a major part in the name, for, as a matter of fact, that which we are most concerned in is light—the judicious use of light—illumination is but a by-product of light. It is possible to obtain light without illumination, but it is impossible to get illumination without light.

With the advent of some present methods, as regards the use of light, emphasis was laid upon the idea that it was not light that should receive our chief thought, but illumination, for it was possible to have much light and inadequate illumination; also that light and illumination were two distinct things. To be different,

rather than endeavoring to rectify misunderstandings, the word "illumination" was seized upon—and overcapitalized, both commercially and scientifically. And it found itself a conspicuous part of the title of a society founded to equitably consider all phases of light and intimate associations.

If the Illuminating Engineering Society was supposed to be concerned only in illumination, than the word "illumination" might be acceptable, but the society, as founded, irrespective of how it may have been conducted, or for what some of its members may stand for, is most vitally concerned in light—its application and the effects resulting therefrom. Therefore, "Light" or "Lighting" should occupy the place now given to "Illumination" in the name of the society.

It might be well here to realize that sign, decorative, spectacular, outline-lighting, etc., all of which are extremely important, might be, and usually are, examples of light without illumination, in the accepted sense of the word, and therefore might find more agreeable association in "Lighting." There are other similar examples.

Now as regards the word "Engineering." I well appreciate the wondrous beauty and significance of this word, as extolled by some of its enthusiastic sup-To some, engineering is assoporters. ciated—and directly—with heaven itself, for do we not engineer our way to the Pearly Gates, and is it not engineering that makes our very life possible, and is it not the most euphonious and valuable word of our language? It stands for every sensible act, and, therefore, is most appropriate in designating all intelligent considerations involved in the subject of light. Such may be one viewpoint, but, fortunately, there are other ideas

worthy of consideration. It matters not what definition some dictionary may accord a word, or how it may be viewed academically; it is the general accepted sense that concerns practical people. The word "Engineer," by most people, is regarded largely as "one skilled in mathematics and mechanics, and who superintends works for military or civil objects; one who runs an engine." And a great many valuable and influential persons do feel, and with just cause, that the Illuminating Engineering Society is primarily an "engineering" institution, whereas, as those who are qualified to know, the strictly engineering features play but a small part of the average successfully designed and applied lighting scheme, for other phases entering thereinto are of equal if not of greater value.

The society is not an "engineering"

body, though its name so states.

Further, most people are inclined to feel that the engineer deals primarily, if not solely, with physical conditions, and usually is not educated or lacks the experience to fully appreciate the value and need of beauty. There may be some engineers who have a well developed appreciation for beauty, but there are very few, relatively, who understand means to such end, or who know the true value of beauty upon our existence, and who constantly and systematically assist in its realization. This idea is not only had by the public, but is shared by such very important interests as architects, decorators, fixture manufacturers, etc. These interests are conspicuous in the Illuminating Engineering Society by their absence. Some of them may be brought into the society as it now stands, but active, constructive co-operation with these and other important interests would be the more quickly established if decided readjustments in the Society were made.

If I did not so fully know engineers I might, based on their sometimes assumed attitude, be inclined to think them most conceited. I rather think, however, their attitude belies their reflected estimation. It may be they are overly ambitious. However, in lighting due recognition must be accorded the fact that physiologists and psychologists can be of some assistance in developing conditions agree-

able to the eye and brain, for these organs, as well as slide rule manipulations, must be considered. It is reasonable to assume that physiologists and psychologists, perhaps also physicists and chemists, would be more inclined to co-operate for the attainment of the realistic ideal in lighting, under a broader name than "engineering"—for they are not "engineers."

Then there are the representatives of gas and electric companies, and manufacturers of lighting equipment. There are represented in the membership of the Society a number of these extremely important persons—and remember, it is these people who are responsible, or who have some relation with the larger part of all lighting installations—yet they represent a very small number, by comparison, with what could and should be the case. Also, the interest of this class of membership is not nearly so great as it could or should be. Why? Are these people, also architects, physiologists, psychologists, fixture manufacturers, etc., etc., wholly to blame? Is the Illuminating Engineering Society doing all in its power to promote these interests? No! Will the act of changing the name of the society perfect conditions? No! But it will do thismake the name truly reflect the object of the Society without a lot of unnecessary explaining, and largely eliminate misconceptions-oftimes dangerous; make it agreeable to all professions interested to become affiliated and with due respect for their dignity; and the increased breadth, as reflected by a truer and more comprehensive name, will, in itself, assist in broadening the attitude and efforts of those now interested in the society, for "clothes" have bearing, not only on appearance, but likewise upon one's mental condition, and if the name of the Society was of a broad, practical nature, we doubtlessly would make an effort to adjust ourselves thereto.

If, coupled with the change of name, the management of the Society would be placed, when feasible, in the hands of a more representative body of men than heretofore and now constitute the Council, the subject of light and its associations would receive more *thorough* consideration and administration.

In an article dealing with the Illumi-

nating Engineering Society appearing in the October, 1911, issue of the ILLUMI-NATING ENGINEER, since named GOOD LIGHTING—note the change in name— I more specifically referred to the management, and stated: "Of the six presidents elected to date, four (4) have been engineers and two (2) physicists; of the one hundred members going to make up the six Councils, forty-two (42) have been engineers, fifteen (15) central station representatives, twelve (12) physicists, twelve (12) editors, six (6) reflector manufacturers' erpresentatives, four (4) chemists, three (3) gas company representatives, two (2) gas and central station representatives, one (1) electrical accessories manufacturer representative, one (1) gas illuminant representative, one (1) fixture manufacturer representative. It will be noted that sixty-six per cent. of the number of presidents have been engineers, and that forty-two per cent. of those going to make up the six Councils have been engineers, and if we take the engineers and those closely related to such profession, or understanding, we find all of our presidents in such class, and considerably over one-half of those going to make up our Councils representing physical conditions involved in the work. It is, of course, but natural that such management would elevate the physical side, rather than the other important divisions going to make up the art and science in its entirety."

If the Society was made more agreeable to all classes, as was the idea when founded, a greater representation could be had of all interests, and from such members valuable officers would be available.

The society needs decided readjustment, and it is better to come now than later, when valuable time and effort have been been wasted. I shall use my effort to bring about a desirable condition of affairs, and would like to work with the Council, provided immediate and continued action is evidenced.

While the society is scientifically, and should be physiologically, psychologically, as well as practically, inclined, it should also duly consider the philanthropical or humanitarian aspects. This, I take it, is granted. Therefore, if such be the object of the Society, philanthropists—it is not

necessary to call them by such name: they may be designated as co-operatorsmight be induced to lend their support, perhaps monetarily, the acquisition of which would enable some very valuable work to be undertaken and accomplished. which would not only be of inestimable value to the organization and the lighting industry, but to mankind in general.

Such arrangement might well solve the very grave financial problem now confronting the Society, where the income from dues is insufficient to meet expenses; and even with receipts from "advertising" in the Transactions, a deficit seems

inevitable.

The question of division of membership has long been discussed in the So-No satisfactory solution of the problem apparently has been found, at least no definite action, to my knowledge, has been taken on such point. We must, though, increase our income, even to continue as at present, and our present methods must be improved upon and expanded, requiring even greater expenditure of time and money.

Suppose we do establish different classes of membership—it can be done successfully. Divide classes somewhat as follows: Patrons, donors, contributing members and members. There may be other classes, and we may designate those indi-

cated differently.

The patron would be a person who, in his or her interest in the work, would contribute the sum of, say, one hundred (\$100) per annum, more or less.

The donor would give, say, fifty (\$50)

dollars.

The contributing member might be assessed from ten (\$10) dollars to twenty-five (\$25) dollars.

The member would be called upon to pay the same dues as in force at present,

or a greater amount.

Perhaps there could also be the associ-

ate member—the student.

This arrangement would not provide "empty titles" or "honorable mention," but it would add materially to the success of the work and organization-and it is in these accomplishments that we are primarily concerned.

If the society was so reorganized, then could be considered the idea of subdividing it into sections, depending upon the class of members, as Architectural Section, Engineering Section, Commercial Section, etc., etc. By this arrangement not only would our income be larger, but the interest in our work would be much greater, besides permitting us to accomplish much more than we are doing at present, or, in many cases, are even not attempting.

My suggestion for the name of the society is "(American) Institute for the

Improvement of Lighting."

Very respectfully yours, (Signed.) A. J. MARSHALL.

P. S.—"As the result of a somewhat recent inquiry made by the writer it was found that a large number of people were agreeable to the change of name of the society, and some who had given particular thought to this idea were very positive in citing their approval."

A. J. M.

The expressions of the Council of the Illuminating Engineering Society relative to the four principal recommendations as tendered by the author are substantially as follows:

First: Regarding the proposed change of name: It was felt by some members of the Council that the present name of the Society was ideal; by others that the name was susceptible to improvement, but that while a change of name might be beneficial in the long run, and more adequately and definitely express the character of the society, that the possible confusion attending such change, even though of a temporary nature, would be undesirable and hardly compensate for any ultimate gain.

Briefly, the Council was, in the main,

opposed to a change of name.

Second: As regards making the management of such a nature as to broadly and intelligently deal with all subjects involved in the consideration of light, both natural and artificial.

The Council felt that such readjustment in the management was desirable, but seemingly was unable to indicate means to such end.

Thrd: As regards establishing different classes of members, such as patrons, donors, contributing members and members, and other similarly rated classes as might be deemed desirable.

The Council, as a unit, was practically expressionless regarding this point. About the only definite opinion was an objection advanced to the effect that such arrangement would place the society in the charity class of organizations.

Fourth: Regarding the sub-division of

the Society by sections.

The Council thought that there might be some import in this suggestion, but failed to make any definite recommenda-

tions or take any action.

The writer publicly thanks the Council of the Illuminating Engineering Society for its consideration of his proposal, but inasmuch as it is felt that the recommendations contained in his letter of April 10 are worthy of more analytical consideration than was extended, and further that the recommendations are worthy, at least in principle, of adoption, and as a full, frank and free general discussion by all concerned might assist the Council in its further deliberations of the subject, the matter is placed before the lighting world and members of the Illuminating Engineering Society in this manner.

The Council of the Illuminating Engineering Society *might* (kindly note that this is an *unofficial* recommendation) be pleased to receive expressions from those interested in matters pertinent to light-

The incorporated letter will, in the main, be self explanatory. However, there are perhaps a few points that might receive further treatment for general elucidation here.

As regards the desirability of changing the name of the Illuminating Engi-

neering Society:

Aside from the well founded reasons advanced by the author in favor of such change, cognizance should be taken of the fact that "illuminating engineering" is generally considered as synonymous with "scientific illumination," and "scientific illumination" is regarded by the great majority as a catch-penny phrase in the disposal of illuminating accessories. Not that the subject of the intelligent use of light is itself a myth—far from it—but the practise of the promiscuous use of "illuminating engineering" and kindred phrases has caused the real value involved to be under estimated.

The Illuminating Engineering Society as it now stands has a commercial taint that will be destructive if not eliminated. The Illuminating Engineering Society should be as great and as broad as the tremendously important field it purports to represent. The Society should disassociate itself from commercialism, especially where such commercial aspect is of such a restricted character. The sooner the Society is purged of this element the more rapid will be its advancement and recognition by important lighting interests that are now chiefly conspicuous by their absence. There is very considerable food for thought in this statement, and careful analysis of the situation will substantiate same.

"Illuminating engineering" in so far as it is understood by the public has received a "black eye," and the sooner that such garment is discarded for one more adequately expressing the better efforts of the movement for improved lighting the sooner will a more extended support be lent.

In my opinion, and I think it will be that of the reader, upon further thought and investigation, the ultimate good attending the change of name of the Illuminating Engineering Society will much more than compensate for any slight temporary confusion that might result at the

time of the change.

One very practical argument in favor of a change of name of the Illuminating Engineering Society is noticed in the somewhat recent change of name of the Illuminating Engineer, a monthly paper first published about the time of the inauguration of the Illuminating Engineering Society, to GOOD LIGHTING. This is an interesting development—and a still even more convincing reflection of the desirability of a change in the name is evidenced by those persons who are really professionally engaged in lighting work —those whose entire time is given to all considerations involved—not simultaneously endeavoring to act in the capacity of electrical, mechanical and ventilating engineers, and "illuminating engineers -who are styling themselves as lighting specialists or lighting experts, they realizing that the title of "illuminating engineer" is synonymous, in so far as public opinion is concerned, with a salesman of lighting accessories, whose knowledge of the subject of light in its numerous phases is extremely narrow and very greatly biased. It would be but natural for those professionally engaged in lighting work to follow for commercial returns the path of least resistance; consequently the title "illuminating engineer" is disregarded and that of lighting specialist employed. Besides, those who are practising the art and sceince of lighting, as lighting specialists, realize that while engineering features play their very important part, that other considerations are, in the aggregate, of even greater importance, and as such are considered.

Physiological, psychological and æsthetic features, not to mention others, can hardly be classified as being engineering, in the generally accepted sense of the word, and it can hardly be shown that strictly engineering considerations play any great part in furthering lighting as a reflector of personality-advertising-or increasing the revenue of central stations and gas companies in producing conditions that are thoroughly consistent and satisfactory to the consumer. It is, however, thoroughly understood that engineering features are a very important consideration as means to the end, but engineering features in themselves, as some would endeavor to have us believe, are not the ends. As a matter of fact, and in full justice and appreciation for the true and established points involved, there is much that is oftimes stated about the engineering of light, as engineering, that comes mighty close to being something that is not substantiated in practise.

The Illuminating Engineering Society is not an "engineering" institution. It purports to deal with other features than can be defined as engineering, such as, example, physiology, psychology, æsthetics, etc., etc. Then why the name? Let the name express the true character

of the movement.

The "(American) Institute for the Improvement of Lighting " tells the story. Perhaps an even better name might be found.

Now as regards breadth in the management of the society. There have been, and are, broad-minded, unselfish, public-

spirited, earnest working men on the Councils of the Illuminating Engineering Society who have done and are doing all in their power to further the cause, and the public owes these workers much for their accomplishments. Unfortunately, though, the councils of the Illuminating Engineering Society have lacked, and do lack, representation that would insure a broad consideration of all phases involved in light, both natural and artificial. the Society bore a name more fully expressing the character of the movement, the objectionable word "engineering" being omitted, and also if there was a less relative evidence of "engineering attitude" and a noticeably higher regard for other important phases, it would not be long before physiologists, psychologists, architects, decorators, designers, fixture manufacturers, representatives of gas and eleteric lighting companies, etc., would be attracted and become more actively interested in the movement, as a movement. The co-operation of these and other important interest would lend very desirable impetus to the efforts of the Society. With the co-operation of such diversified interests obtained, ere long same would be available for active representation in local sections, and eventually very active participation in the general management of the society in its Council.

If the oftimes bitter, usually biased, and sometimes unintelligent criticisms of architects, fixture manufacturers, physiologists, psychologists, etc., by "illuminating engineers" were squelched, and a "get together" policy substituted for the very destructive, and what appears sometimes to be an egotistical attitude, immediate, far-reaching advancement would ensue. The great and valuable possibilities of such constructive co-operation work are

surely worth the effort.

The "(American) Institute for the Improvement of Lighting," properly managed, would offer a very excellent vehicle for such development.

Now as regards the establishment of diffeernt classes of membership within

the soceity.

It is now costing the Illuminating Engineering Society approximately seven (\$7) dollars for each member per year, whose contribution to the society each

year in the nature of dues amounts to five (\$5) dollars. The Society is therefore losing on each member each year about two (\$2) dollars, and as near as I have been able to ascertain as the Society increases in size the deficit per member and in the aggregate increases. The membership of the Society at present is approximately 1500.

The Illuminating Engineering Society in its endeavor to offset the loss reterred to solicits and receives contributions to its Transactions in the nature of "ad-

vertising."

The publicity value of the "advertising" pages of the Transactions is about as near to nothing as one can conceive. Such "advertising" must be, and I suppose generally is, regarded as contributions to a worthy cause. It *might* be called charity. Anyhow, it is *not* advertising.

The plan advanced by the writer would still permit the acceptance of these "contributions," but there would be no "advertising"—the publicity departments of the manufacturers of lighting accessories, who themselves "advertise," would be relieved of the difficulty of endeavoring to conscientiously charge such expenditure to publicity. Besides, it would offer an opportunity for those who are philanthropically or humanitarianly inclined to assist the cause without having to do so through the admittedly valueless "advertising" pages of the Transactions of the Illuminating Engineering Society.

The writer's plan would also permit the division of membership on other than an "engineering" basis, which, if attempted, I feel confident would wreck the Illuminating Engineering Society.

The Illuminating Engineering Society now has under consideration the division of membership on a five and ten dollar a year basis—for ten dollars you can be a sure-enough member, and serve as an officer of the Society—which plan is fundamentally weak and does not have the support of the majority of the Council, but which the writer understands will come before the society at its annual convention, held in Niagara Falls in September, for consideration.

The plan advanced by the author, regarding the division of membership, providing means to increase the revenue of

the Society and to extend its activities, is worthy of careful consideration.

As regards subdividing the Illuminating Engineering Society in sections—departments: This does not refer to *local* sections.

The recommendations conveyed by the author are a distinct departure in so far as their use in the Illuminating Engineering Society is concerned. It will be admitted that the consideration of light, in all its phases, involves thought and work along many lines—the interests are greatly diversified. From what has gone before, it would appear difficult to reconcile all interests on any plan previously adopted and followed, yet co-ordination of effort is not only desirable, but absolutely necessary, if full benefits are to be derived. The various subjects could be grouped and treated under sub-headings, as architectural (call it artistic, æsthetic, decorative—anything that may correctly express the phrase), engineering, commercial sections, etc. Each of these sections could be suitably represented in the council of the society, so that their ideas and results of investigations would receive proper relative and co-ordinated consideration.

These suggestions and opinions are the result of very careful and prolonged thought and investigation. They are, in the main, constructive. They will assist in solving the problem that sooner or later will have to be faced, and while it might to some appear that such publicity involves the use of rather strenuous means, yet the writer takes such means because they appear to be necessary, and while this communication may startle some persons, who would prefer probably to deal with all such matters in a parliamentary manner, even perhaps at the expense of advancement, the writer feels that no amount of publicity can hurt a true cause. As a matter of fact, a fuller and more general understanding by all concerned materially aids real advancement.

Respectfully submitted,
ALBERT JACKSON MARSHALL.
123 Duncan Ave., Jersey City, N. J.

New York, August 14, 1912.

Editor The Illuminating Engineer,
15 West Thirty-eighth Street, New
York:

We wish to call your attention to an article in Good Lighting entitled "Delicate Illumination for New York's Little Theatre," in which you state that the indirect lighting is produced by a copper bowl hidden completely within the upper section of the fixture with nickel surface for reflecting purposes. This is not true.

The indirect lighting which is the principal feature of this fixture outside of its ornamental surroundings, and produces the uniform illumination for the entire surface of the ceiling, is obtained by the use of an especially designed Frink reflector, made for Edward F. Caldwell & Co., who are the manufacturers of the fixture.

We think this statement should be corrected, as it would be practically impossible to obtain such satisfactory results with a polished metal reflecting surface.

Yours very truly,
I. P. FRINK.

W. H. Spencer, Engineering Dept.



CONTRIBUTIONS

- THE EDITOR solicits—subject to approval and without obligation, original manuscripts for use in GOOD LIGHTING.
- Articles of an interesting and instructive nature—well illustrated—dealing with average and unusual conditions—uniquely administrated to—away from the monotonous common place—are most desired.
- GOOD LIGHTING treats with all phases of Light—both natural and artificial.

GCOD LIGHTING And the Illuminating Engineer

H.A.Buck Bus. Mgr. Robert R. Johnson Adv. Mgr.

VolumeVII

Sept. 1919.

Number 7

Editor

Standardization

—The Constructor

The development of equipment—and means to its manufacture—which, upon application—usually as the base or skeleton—permits the establishment of agreeable and desirable results to be obtained in an economical, positive manner.

—The Destructor

The employment of "standardized" material—especially as an external at the undue sacrifice of individuality—appropriateness—breeding monotony—depression—and unnecessary and undesirable commonplaceness.

Standardization? Yes!—Also Individuality.

ALBERT JACKSON MARSHALL.



Warren and Wetmore, Architects.

FIG, 1-VANDERBILT HOTEL

Lighting the Chanderbilt Hotel New York

One these days encounters so much artificial lighting of a commonplace nature that it is with a distinct sense of pleasure that our attention is arrested by a lighting installation which possesses practical merit—and is also artistic. A rather rare, but extremely desirable, combination.

The Vanderbilt Hotel, the lighting of which was briefly referred to in an earlier issue of Good Lighting—the present editor feels the accomplishment is worthy of more extensive, analytical treatment—is the scene of such a happy combination to

a high degree of perfection.

We have heard considerable these past several years regarding the use of artificial light. We have heard architects and fixture manufacturers severely and quite generally condemned for the unintelligent manner that they employ artificial light and accessories. And during the same period our ears have also caught the sounds of expressions, bordering on self-adoration, emitted by persons who, in some instances, have styled themselves "illuminating engineers."

To some "illuminating engineers" the average architect and fixture manufacturer, in so far as lighting is concerned, come as near to being dead wrong—all the time—as a mortal could possibly be. To judge from the attitude of these "scientific illuminators" it would be but a matter of a short time when all lighting would be installed strictly according to their "scientific formulas" and the architect and fixture manufacturer would occupy the positions of onlookers—observing how it should be done.

Well, *these* "illuminating engineers" have had their fling—and what results they have bred!

Lighting installations devoid of all ordinary beauty—not to mention the absence of the higher forms of art.

Monotony to a most depressing degree.

Destruction—elimination—of individuality—character.

Lighting installations robbed of distinctiveness, which in commercial practise is a most valuable advertising asset, thereby lessening the value of light in the consumer's estimation.

Erecting false conceptions of what constitutes real efficiency and economy.

Causing the public, in many instances, to become dissatisfied with light, because of its improper use, the brunt of which criticisms being borne by Public Utilities who are not in any way to blame. And the public is just beginning to become alive to the situation. But the "illuminating engineer" has his. Why should he worry?

These agitators—some "illuminating engineers"—do not represent true advancement that have been made possible, in many instances, by men of scientific minds. This particular species of "illuminating engineers" usually are, in reality, salesmen of lighting equipment, whose knowledge of the subject of light, in its great entirety, is extremely meager and biased. They have masqueraded under the title "illuminating engineer" to permit the easier sale of their equipment. The results of their efforts are readily apparent even to the uninitiated. Their

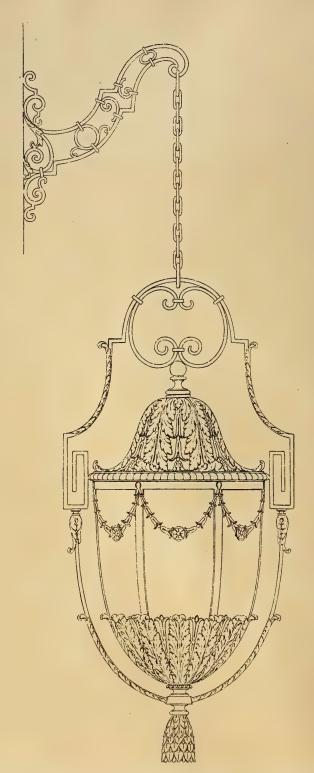


FIG. 2. LANTERN.

mishandling of what are really wonderful achievements and possibilities has, if anything, retarded progress, because they have in their practise sown destruction—instead of creating—and have antagonized instead of establishing friendly co-operative relations with those who are responsi-

ble for the great majority of all lighting installations.

The lighting situation will be the better when the *sensible* engineering features involved in the use of artificial light can be presented in an agreeable manner to the architect and fixture manufacturer in-



FIG. 3.—GARDEN.

stead of the methods that have been in vogue. Also when the architect and fixture manufacturer realize that through the proper employment of many advanced ideas having to do with the physical and physiological that effects may be obtained which will find artistic favor, and while

the rights of all concerned. The heretofore practise of biased, destructive criticism will get us nowhere.

We have seen much to condemn in lighting installations and much that is meritorious. We know of some lighting installations, perhaps chargeable to some



FIG. 4.—TELEPHONE LOBBY.

using illuminants and accessories of high efficiency which permit of comparatively inexpensive maintenance. Also effects that are not injurious—agreeable to the eye, the *first* and *most* important requisite of all lighting.

Such development will come only through association with full respect for architects and fixture companies, that seem to have been employed with little or no consideration for the purposes for which they were intended—in some instances lighting equipment representing chiefly a commodity that was exchanged on a basis of the metal contained. As far as light-sources are concerned—well, they just did



FIG. 5.-MEN'S WRITING ROOM.

manage to become incorporated with comparative little chance to exercise their character. Also the quite conspicuous displays of solidified sand—glassware.

On the other hand, we know of lighting installations that have been installed with almost a total disregard for everything else save false notions of "efficiency" and "economy," employing contraptions in the form of characterless, unsightly metal parts, suspending some panacea for all light ills which, wholly or in part, may have surrounded a truly efficient light-source.

Here we have represented what is probably the two extremes in lighting practise. On one hand the excessive use of design—over embellishment—and a lack of appreciation for practical considerations. On the other hand, a perhaps well meant effort to obtain good lighting effects econonomically and efficiently, but in many cases with more or less disastrous results.

To-day the lighting situation is in a state of chaos.

With a more general appreciation for the greatness of light, and the countless ways in which it may be successfully employed, we may hope to witness real advancement.

This may, at first thought, appear to be rather an odd way in which to open up an article treating with the lighting of one of the New York's newest and most palatial hotels, but the opportunity for us to express ourselves on a subject we will dabble in much hereafter was too good to let escape. If it were possible for the reader to avail himself the privilege of closely examining the lighting of the Vanderbilt Hotel he would readily see how, in many cases, those responsible for this installation have taken the good points from various lighting theories, discarding those which lack merit, and how undesirable extremes have been studiously avoided.

Those who have not had the pleasure of viewing the Vanderbilt Hotel and its lighting appointments may derive some pleasure and profit by a perusal of this article.

The Vanderbilt Hotel, designed by Warren & Wetmore, architects, was opened to the public a few months since.

This twenty-two story edifice (See Fig. 1) rendered in Italian Renaissance, is located on Thirty-fourth Street and Fourth Avenue, extending a full city block on the latter street. It is one of the most distinctive and imposing buildings in New York, and its position is commanding, it being located close by the Grand Central

(See Fig. 2), as are, in fact, all lighting fixtures used in the Vanderbilt Hotel, were conceived and executed by the Edward F. Caldwell Company, of New York. The design of these lantern fixtures marks a departure that is agreeable.

The interior of the Vanderbilt Hotel is in the Adam style, although quite a



FIG. 6.—LOOKING INTO MEN'S WRITING ROOM AND JAPANESE ROOM.

Terminal group, also designed by the same architects.

Even before entering the hotel we find evidences of craftsmanship beautifully expressed in the unique lighting fixtures suspended in lantern-like form immediately below the mezzanine floor level on the exterior of the building. These fixtures different development from that applied in the Ritz-Carlton, also designed by Warren & Wetmore. The effect is one of simple yet great beauty.

The Lobby is practically continuous into the Garden, illustrated in Fig. 3. The ceiling of the Lobby and Garden is vaulted on low elliptical lines, the masonry of the



FIG. 7.—JAPANESE ROOM.

arches and pillars being uninterrupted. The material is an exact simulation of light buff sandstone pointed with mortar.

The only architectural decoration is a frieze of dull gold, above which are bas reliefs after the manner of Della Robbia. The floor is of marble, which has rich tones of brown and maroon. The rugs, the design of which are of Chinese origin, are colored in royal Chinese blue with beautiful medallions and duo-tone centers. The tapestries harmonize with the rugs.

Suspended from alternate vaults in the ceiling are massive crystal chandeliers, each of which contain twenty-four tungsten lamps, which are so arranged as to be entirely hidden by the glass decoration. It is scarcely possible to conceive anything more brilliant without being simply glaring than those magnificent specimens of crystal fixtures. To the pillars are attached exquisitely wrought bronze brackets supporting vases from which there are flower-like sprays of small electric bulbs which are stained a deep golden yellow. These add a warm note to the general color scheme and serve as decorations.

On a finely executed base rests a wonderful vase, supporting a group of candlelike illuminants, which are, in turn, individually (partly) surrounded by pinktinted silk shades. More, further along, will be said in reference to these shades.

In the room beyond will be noted three different types of illuminants, one an upright standard supporting a beautifully chaste glass bowl, which probably represents the highest development of glass manufacture in the world to-day. These upright standards and wall pieces are best seen in Fig. 4, the Telephone Lobby. These, and other features of the Vanderbilt Hotel, and especially the lighting thereof, must be seen to be appreciated.

Fig. 5 depicts the Men's Writing Room, which is lighted by three distinct types of illuminants. One a special bronze bracket supporting, in a horizontal plane, a cylindrical formed body containing a straight filament lamp, which, in turn, is partially surrounded by a special type of reflector. These units are primarily used for lighting desks in their immediate vicinity.

The two side (wall) brackets suspend attractive bodies, which carry a number of small round bulb all frosted lamps, producing an agreeable effect. Even better results would be obtained if the intrinsic brilliancy of the lamps had been modified and their color corrected. Such changes could very easily be had by using the same type of lamp, but "burning" it under voltage; that is to say, using, for instance, a 130-volt lamp on a 100-volt circuit. There being less "pressure," a lower order of incandescence would be produced which would mean more red and less blue. The effects of many delightful interiors, where "warmth" is desired, are spoiled by the use of unmodified "cold" illuminants. In fact there are many interiors which, with the older type of lamps, with their rich yellow and red, have been very considerably changed, and not for the better, by the substitution of untinted tungsten lamp. The fault is not, of course, with the tungsten lamp, but with the way it is employed.

In Fig. 6 we have another view of the men's writing room, also a portion of the Japanese Room. The semi-indirect lighting unit shown in Fig. 5 of the Men's Writing Room is, in Fig. 6, more conspicuous, while to the left will be noted a beautiful bronze figure resting on a base supporting an equally attractive cluster of candle-like illuminants, which are, in the case of those shown in Figs. 3 and 4 (partly), surrounded by specially prepared silk shades.

A word here relative to the silk shades used in the lighting equipment of the Vanderbilt Hotel would probably be in order.

To the casual observer the silk shades are similar to, if not like, most other silk shades. But, in so far as their lighting properties are concerned, they are unlike any that have been similarly employed These silk shades, which are before. daintily fashioned and appropriately employed, are "filled," as it were, with a special solution evolved by Mr. Peter Cooper-Hewitt, which is of the nature of varnish, having the property of abstracting a certain amount of green in the light produced by the illuminant, and transforming a certain percentage of the blue and vellow rays into pink, giving a quality

of light even more desirable than that obtained from the candle. The character of the light obtained from these "filled" shades permits of better discernment of various tints of white than is possible when the ordinary candle is employed, which latter illuminant has a tendency to run to orange-yellow. The use of this correcting agent assures the appreciation of the gentler sex, for their delicate complexions are favorably administrated to.

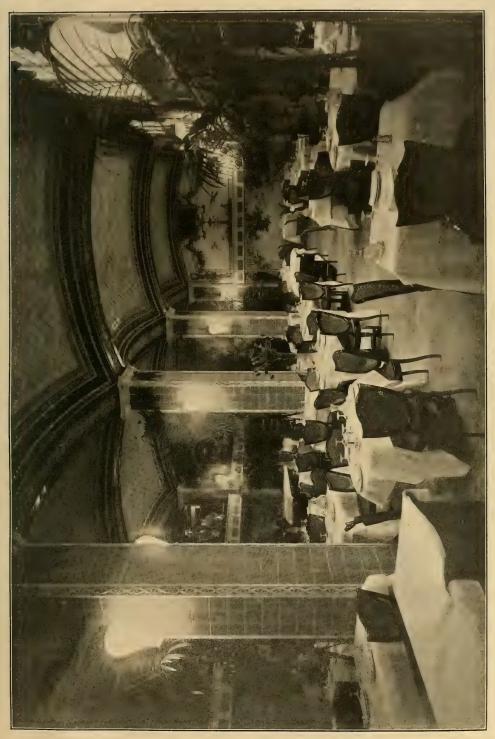
The special filler also enables a very superior diffusion to be obtained with low absorption. The diffusion is so complete that no part of the light-source is visible. It is stated that the absorption, in the case of the treated silk shades, will be fully 20 per cent. less for the same degree of diffusion obtained through other diffusing mediums. The filler also has the faculty of holding color, it being non-fading.

We have here an excellent example of a well worth while development, created by one of our foremost scientists, who, fortunately, has an appreciation, not only for the purely physical, but for other equally important phases as well, that have been accepted and employed by the architect. In fact the other day, when the writer was conversing with Mr. Wetmore, he (Mr. Wetmore) laid very considerable stress upon this feature of the Vanderbilt Hotel lighting installation, showing that he was not only appreciative of the results obtained, but of the cooperation extended by Mr. Peter Cooper-Hewitt. The use of similarly treated silk shades with "cold," "hard" tungsten lamps, when used in the living quarters of the home, where repose and relaxation are desired, should prove most acceptable.

Mr. Peter Cooper-Hewitt is to be congratulated upon his creation and Mr.

Wetmore for employing it.

The Japanese Room, Fig. 7, is one of the most thoroughly enjoyable and delightful rooms it has ever been our pleasure to visit. The lighting appointments are as agreeable and consistent as are other factors in its decoration. There is perfect harmony. How seldom is it found! The general lighting of such a room, as illustrated, should not necessarily be high; in fact, the soft, easy, restful tones and low intensities are much more in keeping



with lounging. The general illumination is partially contributed through the medium of Japanese lanterns suspended from the soffets of the beams near the center upright. Naturally, in the vicinity of the official dispenser more illumination is required in order that one's favorite concoction may be compounded with considerable degree of exactness. The lighting is here provided for by a group of candle-like illuminants, arranged in a semi-circle about the lower part of a mirror, which forms part of the lighting fixture.

tively lighted. The illumination is provided for chiefly through the medium of most satisfactory table lamps, so arranged and equipped as to produce that low, "soft" tone of light so sought for by the gentler sex.

The lighting in the restaurant proper is obtained from a most unique lighting fixture, which consists of a beautifully wrought bracket, suspending by a chain a harmonious metal holder and a single piece of alabaster-like glass in stalactite formation. This unit can successfully lay



FIG. 9.-ELEVATOR LOBBY TYPICAL FLOOR.

And while we are still considering administrating to the inner man, we might note the general arrangement and lighting of the Della Robbia restaurant, shown in Fig. 8. The columns and vaulted ceiling of this room are entirely in terra cotta, showing a grayish-white and delft blue. To the left will be noticed a balcony, which is also equipped for dining service. This balcony, in fact, is quite a favorite location, which appreciation is accountable for several reasons: First, it is cozy; secondly, it affords an excellent view of the main room, and, third, it is very attrac-

claim to much merit. The effect, unfortunately, is somewhat marred, due to the fact that the inclosed light-source, which is of the tungsten type, is dropped down in the glass proper, and owing to the high intrinsic brilliancy of the illuminant, and its relation to the transmitting media, a spot of light is visible, which detracts from the delicate design traced on the glass. The effect is more or less disagreeable and injurious to the eye. The condition could be easily bettered by employing a straight line filament erected in a vertical plane, or, even better still, housing a special



FIG. IO.—SALON.



FIG. 11.—BEDROOM. 325

stereopticon filament incandescent lamp well up in the metal holder, backed by a powerful opaque silvered reflector, which would drive the light rays into the stalactite, assuring perfect diffusion and ability to discern details. Such arrangement would be also more agreeable to the eyes.

We now depart the public quarters and arrive at a Typical Elevator Lobby, as shown by Fig. 9. One of the most conspicuous features of the lighting arrangement here illustrated is the happy co-ordination of lighting equipment and elevator floor indicators. Still more interesting is the fact that the lighting equipment, which is in the best of good taste, is so devised and arranged as to permit the instant reading of the indicators. We have seen some examples of similar lighting where the results, even considering only the illumination features, have been less suc-

cessfully handled.

The value of a hotel is not wholly judged by its public quarters; in fact, that which usually forms the basis of our attitude toward a hostelry is the service obtained in the private quarters. Note Salon and Bed Room, Figs. 10 and 11. Here the Vanderbilt Hotel, as is the case throughout this wholesome, uniquely good establishment, offers a service which is augmented by the lighting system employed. The lighting fixture shown in Fig. 10 is a combination direct-indirect type. The four candle-like illuminants, equipped with specially treated silk shades, create the impression that the general illumination obtained is produced solely by them. They also tend to dress up what might otherwise be an unattractive unit, not that the fixture in itself lacks beauty, for it is an example of the highest art of metal working, but its opaqueness, without relief, against a fairly brightly lighted ceiling, obtained from lamps in inside (back) part of disk, hidden from view, would lend a discord to the otherwise perfectly appointed interior. It is touches like these that show the master hand, and the more such influence may be manifested the more enhanced will become lighting equipment.

Fig. 11 shows a Bed Room with an orig-

inal form of fixture, which is productive of a semi-indirect lighting effect. This, as well as other lighting fixtures employed in lighting the Vanderbilt Hotel, will bear close inspection, and the more complete the inspection the greater will be the observer's appreciation of what has been accomplished. It will be noted that the small table at the right of the bed carries. besides the telephone and the match-case, an attractive portable lamp, surmounted with a specially treated silk shade.

There are many other lighting features in connection with this hotel that would be very difficult to attempt to set forth through the medium of photographs. For instance, in some of the rooms the lighting produced by the regular fixtures is supplemented by light thrown from behind draperies, etc. There are other unusual conditions, which are very inter-

esting.

Probably the next several years will see considerably more effort expended in refining our lighting agencies, and their application, than has been the case these last few years, during which time we have been most concerned in creation, and with wonderful success. The Vanderbilt Hotel lighting installation is a step—and a long one-in the right direction, and one which all concerned have just cause to be proud of. And the probabilities are that if these gentlemen had been given even greater leeway in the design and application of lighting equipment the results obtained would have been of an even higher order, and this is said with no lack of respect for that which we have.

The writer, in talking with Mr. Wetmore, had further cause to appreciate his knowledge of lighting—at least the effects he sought. Mr. Wetmore, in talking of the lighting of the Ritz-Carlton Hotel, which hotel he also designed, stated, that in the Main Dining-Room he had provided three separate, distinct changes of lighting values—at luncheon, what he styled as a daylight value is produced; at dinner, the brilliant, gay, buoyant light, and at supper the cozy, subdued, gloaming effect—and this all in one room, Sure-

ly evidence of thought and effort.

IMAGINATION

(Reprinted through the courtesy of the Cosmopolitan Magazine)

F a supremely great man—wise above others to see the truth in its proportions and put the first thing first—were summoned suddenly to die, and were given a moment only to sum up his discovery of life, I think he would say in substance what follows. I think so because this is, as I understand it, the message—not in the words but in the sense of them—that was actually given to the world by the Greatest Man we know:

The secret of beauty and power lies in the right use of the imagination, for it is the imagination—the ability to concieve things that do not exist—that distinguishes men from animals, and makes it possible for men to escape from creaturehood and become creators. Now the right use of this faculty to conceive delightful things that do not exist is to make them exist. If the faculty be otherwise used—used to accuse or deceive others, or to create a mere no-man's land of dreams—it will in the end make one sick and impotent, and spread disease and weakness all around one.

To have ideals and not use them is sin and death.

Those who live well are those who, by faith, daily perform the miracle of making some coarse thing fine—by an adventure of the creative imagination.

The charm of a woman is not in the delicacy of her ideals, but in her daring to use them in homely circumstances. The dignity and fame of a man consist in his being at once idealistic and executive—driving the sword of the Spirit deep into the bowels of Fact.

The heavens above us are latent with creative lightning, and the gross earth electric with expectation. The imagination reaches for the thunderbolts to subdue the earth. And the secret of beauty and power is to make one's own body the vehicle of this fire from heaven.

Charles Ferguson.

Utica's New Street Lighting Installation

By D. C. SHAFER

A fitting ceremony in the celebration of "Utica Day," on August 20, was the turning on of the new ornamental luminous arc lamps along Genesee Street. A platform had been erected at the corner of Lafayette and Genesee Streets, where Mayor Frank J. Baker and other city

strung across the streets, draped from the buildings and incased in Japanese lanterns to decorate verandas and lawns.

The installation on Genesee Street now composes sixty-six of the new luminous arcs, extending all the way from Bagg's Square to Washington Street. These



FIG. I.—DAYLIGHT VIEW OF GENESEE STREET, UTICA, SHOWING ORNAMENTAL EFFECT OF NEW ARC LAMPS AND POSTS.

officials, representatives from the Chamber of Commerce and guests from other cities gathered at 7.30 to witness the first splendor of the new lamps.

The city itself was in darkness up to the time the Mayor turned on the new lamps at 7.30 o'clock. This burst of illumination was soon followed by the turning on of thousands of small incandescent lamps are mounted on the tops of ornamental poles, placed at intervals of 100 ft. on opposite sides of the street.

While these sixty-six lamps were installed in time for the celebration, they comprise but a portion of the number planned for the city. Ultimately nearly four hundred of the new luminous arcs will be installed in Utica. Already six-

lamps, of varying colors, which were teen have been ordered for the overhead

bridge crossing the New York Central tracks at the foot of Bagg's Square. These lamps will effectively illuminate the bridge and its approaches. Bagg's Square will be lighted, including the short stretch of street to the New York Central Depot. Bleecker Street will also be lighted, fourteen lamps being planned for the first three blocks east of Genesee Street. On the other side, Lafayette Street will be illuminated for an equal distance. Other downtown streets are also planning for the new arc lamps.

vention held in that city the question of better lighting became vital. A committee from the Chamber of Commerce took up the work of securing better illumination for the business section, believing that a nicely lighted street would bring in enough new business to more than pay the expense incurred. This committee, composed of Messrs. Thomas W. Johnson, John Slauson, Edward Martin, John J. Booth and John White, found the merchants along Genesee Street ready to contribute their share, which was figured at



FIG. 2 .- NIGHT VIEW OF GENESEE STREET, UTICA, LIGHTED WITH LUMINOUS ARC LAMPS.

The Parkway Boulevard to Roscoe Conkling Park will also be lighted with luminous arc lamps. Sixteen lamps have been ordered of a special design for this work. These lamps will be placed on 18-ft. poles, and this elevation will enable them to be placed at intervals of 475 ft. apart and still insure a fine distribution of light.

The work of making Utica one of the best lighted cities in the country began early last June. After the Mayors' Connot more than \$2 a lineal foot of frontage.

Up to the first of the next year the business men will also refund the city for all extra cost for current in excess of the fund provided to maintain the old arc lamps which have been removed. After January I the city will provide for the maintenance of all the arc lamps.

While the merchants bore the cost of the new lamps, the cost for the ornamental poles and for the concrete bases, the Utica Gas & Electric Company connected up the lamps at their expense. Mr. A. T. Throop, general manager of the electrical department of that company, promised that the lamps would be ready for "Utica Day," and they were. A new cable was

specially designed bronze pillars, are equally as ornamental by day as by night. The lamp is designed so that the mechan-

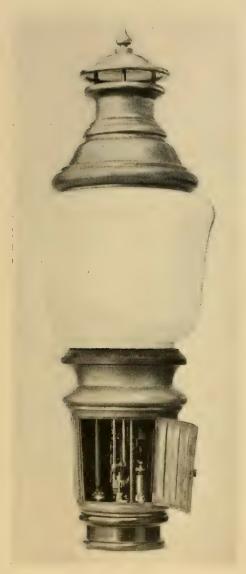


FIG. 3.—DIRECT CURRENT SERIES ORNAMENTAL LUMINOUS ARC LAMP.

laid along Genesee Street and the work of connecting up the lamps was pushed day and night.

It is noticeable that the new luminous arc lamps, being mounted on the tops of

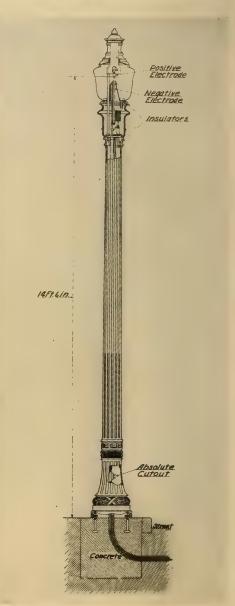


FIG. 4.—DIAGRAM OF WIRING CURRENT SERIES ORNAMENTAL LUMINOUS ARC LAMP MOUNTED ON POST.

ism is concealed in the top of the ornamental post, leaving nothing visible but the white globe and the cap. These pillars,

standing at stated intervals along both sides of the street, add greatly to the general appearance of the thoroughfare.

The new lamps are the 6.6-ampere direct-current series ornamental luminous arcs, and they are operated from arc generators. Each lamp consumes 510 watts of current and will give approximately 1000 candle-power. These arcs are ideal for ornamental street lighting, because the greatest intensity of light occurs about 10 to 30 degrees below the horizontal plane of the lamp, giving a maximum amount of light over the entire street area and, at the same time, illuminating the adjacent buildings in detail. The light is always steady and constant throughout the length of the trim, and there are no brilliant points of light to dazzle the eyes. The globe is always completely filled with light and it eliminates all shadows because it forms a secondary source of illumination, the arc being quite invisible.

The mechanism of the lamp itself is simple and trustworthy. Only one electrode is required at each trim, and then it is not necessary to remove the globe. The chimney and top ornament is merely raised and swung to one side, so that the lower electrode can be pushed down into position. This also provides access to clean the lamp and globe. A cut-out located in the base of the lamp provides means of disconnecting the lamp before trimming.

Globe breakage is reduced, owing to the

fact that the globe is some distance from the arc and that it does not require complete removal for cleansing purposes. The large amount of illumination available from these lamps makes it possible to space them further apart, requiring fewer lamps than any other form of ornamental street lighting.

The arc lamps are mounted on the top of ornamental iron columns, which were made in Utica, by order of the Chamber of Commerce. The mechanical parts of the lamps seem to be part of the post, and only the white globe is noticeable. These posts, fluted bronzed, extend 14 ft. above the sidewalk, and they gracefully taper towards the top, where a flaring 9-in. base is provided for the lamp. The posts are arranged on alternate sides of the street, about 100 ft. apart, and the light distribution is very uniform. All connections are made in conduits, so that the wiring is entirely concealed.

It is a misnomer to call Utica's new street lighting system "ornamental," because it is more than that. It is, first and last, strictly a business propostion. Results have proven in other cities that merely lighted streets are the city's best asset. It attracts new business and new inhabitants, and on those nights when the business places are open there is no question but that a well-lighted street makes more business for all.

Submarine Light for Police Boat

The submarine light has long been a practical reality, but its use as a means to help the police in their ordinary routine work was left to the Chicago Police Department, says Popular Mechanics. The submarine light will be part of the equipment of a new motorboat that was recently launched on the Chicago River, and will be used to expedite the work of recovering the bodies of the drowned. This will largely do away with the slow dragging method now in vogue, where the searchers must run back and forth over the river bottom with cumbersome and inefficient grappling hooks. It will also be

of great assistance to the divers when they are working below the water.

This particular light consists of a cylindrical tungsten bulb of high power, whose rays are refracted through a heavy triangular prism of glass, so as to light a large area on the bottom of the stream. The light is said to be of such intensity that the river bottom may be plainly visible to depths of 18 to 20 ft., and will be partially illuminated in depths ranging from 20 to 30 ft. The light is of especial value in Chicago, because of the large number of accidents that occur in the Chicago River where the water is dirty.

Lights of By-Gone Days

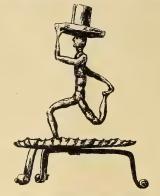
(This article, originally appearing in the September issue of the Edison Monthly, is republished through the courtesy of the New York Edison Company.)

The fear of darkness has been one of the most disagreeable obsessions of the human race, persisting throughout the ages, almost as an inheritance from primitive protoplasm. It haunts our childhood,

evoking in the terrors of the night unmentionable shapes of fairy lore, reminiscences of those early times when the beasts of scientific and fairy book fancy were doubtless man's nightly visitants. Its psychological effects are depressing. When unduly prolonged it means moral deteriora-"Night" and "death" have similar derivations in the vocabularies of our mother tongues. They have been

associated in our literatures and religions, grim shapes of heathen and Christian fancy, in dark contrast to the Apollos and Balders and Devas, shining and beneficent gods of light and strength.

Without doubt darkness is the hereditary foe of man, and he has spent nearly a dozen millenia in the futile endeavor to



IRON CANDLESTICK OF GERMAN MAKE (1400 A. D.)

And. strange to say, subtly as modern man has wrought to escape the power of darkness, this original primeval form of lamp has persisted, not only in the direct course of evolution of Egyptian, Greek and Romlamps, but in far removed western interiors where one would not expect the light of Oriental understanding could penetrate. For, not many years ago, there were to be seen in the kitch-

free himself from its noxious presence. Thousands of years ago there was light of an artificial sort to illumine his uncongenial surroundings. To be sure, it was a very poor kind of light, and the lamp

which bore it a mere conch shell over the rim of which projected a wick, steeped probably at the interior end in oil extracted from the fat of animals, but it sufficed for man's needs, for at this time books were not. nor yet tablets of clay. Such was the inventive genius of some early race which inhabited the valley of the Tigris and Euphrates before ever Babylon was or Ur of the Chaldees.



GOLDEN CANDLESTICK OF SOLOMON'S TEMPLE



A PRIMITIVE CANDELA-BRUM (SCOTLAND), THE STICK HOLDING A SPLIN-TER OF RESINOUS FIR



ens of the Isle of Man lamps formed of the hollow shell of the large scallop, or "taurrogan," a rush or wisp of rag, or a piece of weaver's web, immersed in fish-oil or goosegrease, serving as a wick.

Of course it is not to be supposed that the notion of artificial lighting came by leaps and bounds. In fact, it was one of the tragedies of human existence that it arrived so slowly. But life in those prehistoric days was arduous, not to say enervating, in a wild sort of way. Some courage was required to turn even a rush

light or blazing stick on one's surroundings, and an arc light would have revealed unmitigable horrors. So the evolution of the lamp was slow, befitting early man's

station and strictly local interests. He had invention enough to fasten the rim of his shell - shaped stone, clay or alabaster lamp into a form convenient for the wick, and by the time the tooth and claw period of his existence had become an obsolescent memory he had acquired sufficient mentality to cover the lamp, leaving a hole through which the wick protruded.

About this time strange reticulated and curved lines began to appear upon the lamp, evidence

that utility was not the only guide in its manufacture. Here and there a handle was added and occasionally adorned with the head of a beast, remindful, no doubt, of some ancestor or titular divinity, which had passed from active service into respectable legendary retirement.

Such were the lamps found in Bisnya, at Babylon, in Egypt, Greece, Rome, wherever excavations have been made and evidences found of man's uncontrollable aversion to darkness. In them all might be traced from the simple shell to the ornate



bronze and iron lamp of later Roman and Christian times a consistent development, and of this a lamp found in the ruins of Carthage is confirmation.

But after all, considering the general importance of lamps and the all-pervasiveness of Light in his philosophies and religions, the backwardness of the Oriental lampmaker is much to be wondered at. His native product remains to-

day what it has always been, a simple disk of clay or bronze or stone, the wick resting upon the edge of the dish dented for its reception. was the lamp of Haroun al Raschid, doubtless the same in form as the famous lamp of Aladdin, used to summon the opulent slaves at his bidding. The luxurious Oriental tale was a forecast of an Occidental happening. Modern slaves of the lamp do not call forth palaces from the void. Revelation, not creation,



GERMAN CANDLESTICK (1200-1300 A. D.)

is their mission. But the sordid, unimaginative soul, who, viewing the western metropolis with its flashing electric lights, its

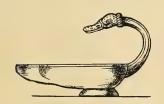


ANCIENT CONCH SHELL (FIRST FORM OF LAMP)

office palaces of stone and marble, its richly decked windows and pleasure-seeking throngs caught in the gleams of myriad arcs and tungstens, sees no likeness between the two, is as much of an anachronism in an intelligent world as would be a cave man on Broadway or the story of

Aladdin in a technical journal.

However, as yet, electric lighting was not, and lesser illuminants were to come. Meanwhile rush lights, tapers, candles their invention is attributed to the Celtsfeebly punctuated with points of light the dark interiors, or were borne by slaves in wedding, funeral and religious processions through the dirty, unlighted streets of ancient cities. For, though torches and lamps were provided in



EARLY ROMAN LAMP (FIRST CENTURY)

abundance at the ancient games and pageants, making, no doubt, an imposing spectacle, anything like street lighting, except for holiday purposes, was probably unknown until in the sixteenth century crude attempts were made to light the city of Paris by requiring all householders to place lanterns in their windows.

Always, everywhere and by all, the lamp was held to have a religious significance, or if not the lamp, the candle. By what precise means the lighting of the old Greek temples was accomplished may still be a mooted question. Certain it is that their rich interiors, gorgeous with paintings and tapestries and musical instruments, holding within their walls the contributions of opulent states and individuals, were lighted by artificial means. At all events, we know that the lamp was sacred and its flame perpetual, its extinguishment being a mortal offense. In Roman times one of the most beautiful articles in common use was the candelabrum, a slender stand, its base supported by griffin's or lion's claws and bearing on its top a receptacle for a lamp or candle. In all shapes and sizes these ancient lamps and their lamp furniture were made, sometimes of beautiful design, the stands representing the trunks of trees with lamps suspended from the branches. There were lanterns, too, in those days,



BABYLONIAN ALABASTER LAMP (4500 B. C.)

although they became more common in the Middle Ages. But their bulky, boxlike forms were little susceptible of artistic development, and while they were useful in their way, and gave us the first form of street lamp, and held an occasional ornamental value, the patrician lamp and graceful candlestick remained in ecclesiastical favor. Yet some of these lanterns are of historic interest, like that one, rude in form and workmanship, carried by the Lady Grizel on her nightly visits to her father, Sir Patrick Hume, during his concealment beneath Polwarth Church. And so the development proceeded, seeming always to have been more

or less closely corelated withthe architecture of the mediæval period, the religious motive which dominated the latter reappearing again and again in the decorative designs of the lamp and the candlestick. The influence of the revival of classic



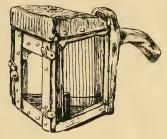
TAILOR'S CANDLE (ENGLAND, 17TH CENTURY)



BABYLONIAN LAMP (ABOUT 3800 B. C.)

architecture was felt, too, by these sensitive bearers of the mysterious light, although this occurred as late as the beginning of the nineteenth century. But here the connection is obvious. In the French palaces of the time all objects which served the purpose of lighting were made under the direction of the same smiths and artists who had in charge the composition of the interiors. To Perrier and Fontaine,

it is said, where the perfection of these objects, among them the candelabra of the Palais de Trianon and the beautiful girandole of the Palais de Fontainebleau.



LADY GRIZEL BAILLIE'S LANTERN (1684 A. D.)

"Cold Light"

By Dr. Robert Grimshaw.

"Cold light," except that which the glow-worm and the firefly generate at will and phosphorescent objects show, has usually been classed in the same category as what boys call "sky-blue pink." But the problem of producing a cold light by electrical means seems to have been at least approximately solved by a Frenchman, and by a process which suggests that world-renowned gentleman whom the Germans claim to be descended from the Nürnberger Taubert, but whom English-speaking people insist on calling Columbus—probably for the reason that his right name was Colombo.

According to Mons. Wilfrid Roques, of Paris, to whom I am indebted for some interesting notes made by him, Mons. F. Dussaud produced the cold light with a lantern 17 x 10 x 10 centimeters in dimensions, weighing only 900 grams, or just 2 pounds avoirdupois, and containing

two concave mirrors. The source of light is an incandescent electric lamp with metal filament, receiving its current from an accumulator, through the means of an interruptor, so that the filament is result nately incandescent and dark.

The current is, however, in the regint he with such rapidity that the effect regint he retina is that of a continuous econdmination. Mons. Dussaud's there in a that during the "resting" periods this the filament it has time to cool down. The current employed is of 1½ ampt, es, with 8 volts tension, and the glass bulb remains cold to the hand. The light is strong enough to enable color projections 1.75 x 1.75 meters in size.

The advantage of the "cold light" is that objects may be studied which would be destroyed or altered by the heat of any other intense source of light. We may thus look further into nature.



Signature Control

Illura and Visual Acuity

In the course of an investigation into defects of vision among school clildren in Liverpool some interesting results were obtained, showing the effect of poor illumination on vision, and we print below a note on these results vich recently appeared in the Medical Officer:

At Liverpool last year in the endeavor to find some of the factors upon which acuity and defects of v. A depend, the eyesight of a certain number of children aged thirteen from nineteen schools near the city boundary, thirteen in the intermediate. If fourteen in the poorest meighborns is einvestigated, the result being shown in excentages in the accompanying table:

It would appear that in each of the columns the vision is better among the children attending the well-lighted schools than in those in which the lighting is less satisfactory, the columns to which special attention should be drawn being those headed "vision excellent" and "both eyes defective." The "vision excellent" column refers to those whose vision is normal, the "good or fair vision" column to those whose vision is not worse than sixninths for one eye and six-twelfths for the other. Dr. Hope considers that the differences in the percentages in the various columns are sufficiently large to show that there is a relationship between the lighting of the school and the vision of the chil-

rols	Number Examined	Vision Excellent	Vision Fair or Good	One Eye Defective	Both Eyes Defective
Outskirt Schools- Boys Girls	. 466	53·43 42.80	27.90 38.00	4·72 5·84	13.95
terrupted ys		49.90 42.40	27.02 28.20	7.90 9.40	15.16 20.00
illu Centra -	° '	28.75 24.46	39.50 33.86	7.41 11.15	24·34 30·53
· · RQ,					

" Fron live vrites Dr. E. W. Hope, M.O.H., the ould appear that the vision becomes ssively worse as one goes g districts to the center from the of the city. ... w much of the defective vision if the center of the city is due to the wint of open spaces and to the need for use of the eyesight for distance, and how much of it is due to some hereditary visual defect, or to social conditions or other factors, it is difficult to say. Probably the question of nourishment is an important element."

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The following table shows the relationbetween the lighting of certain schools re vision of the children attending

dren. There is also to be explained the fact that, with one exception, the girls' eyesight is distinctly worse throughout than that of the boys, and in that exception the numbers investigated are not sufficiently large to exclude the margin of error. Dr. Hope points out that there is one most important factor—namely, sewing-which operates in the case of the girls, but not in the case of the boys, and which is probably the cause of this greater frequency of defective vision and diminution of normal vision. "This," he writes, "which is the most likely of any item in the school curriculum to affect the evesight, is often carried out under the most disadvantageous conditions of lighting.

The stitches under the best conditions are difficult to see, but when sewing is undertaken in classrooms with defective lighting, in rooms where the lighting generally is good, but comes from the back of the children, or on dark afternoons when sometimes the children have to do needlework without the aid of or with an insufficient amount of artificial light, a con-

the children are in nts, and Dr. Hope desirable if sewing altogether under the age of several crimination during sewing lessons convern children whose eyesight has been found to be satisfactory and those with serious defects, these latter

Schools	Number Examined	Vision Excellent	Vision F ir or G'	One Eye Defective	Both Eyes Defective
Outskirt Schools— Lighting Good Boys Girls	316 321	54·43 44.86	^{27.05} 36.45	4·75 5.61	12.97 13.08
Lighting Poor BoysGirls	150	51.33 38.61	28.00 41.14		16.00
Intermediate Schools— Lighting Good BoysGirls	394 396	50.76 48.23	27.16 23.99	8.63 9·34	13.45
Lighting Poor BoysGirls	213	48.36 30.16	26.76 37 04	63	

dition of eyestrain is produced which cannot be otherwise than harmful. It is very important that teachers should receive definite instructions to cancel needlework on dark days, and that they should be able to take these lessons when more suitable conditions of lighting arise."

There is a general consensus of opinion that defective eyesight is partly attribut-

children being expect to come up to the general standard of the class—a result only to be obtained at the risk of serious eyestrain. Now that each department in Liverpool schools has an eyesight register, with the vision of each child recorded, he seems to think there should be in the future no difficulty whatever in this discrimination.

Insufficient Illumination Means I Workmanship

An interesting illustration of the effect of poor illumination on workmanship was given by Mr. J. M. Smith in a recent article on mill lighting in *The Electrician*.

Until recently, he explained, summermade cotton goods were invariably more expensive than those made during the winter time. The reason for this was that better work could always be done by daylight. The artificial light largely utilized in the winter was a limitation to the skill of the workers, and the quality of the goods suffered. We may believe, however, that this difference is largely a matter of the way the light is used, and that greater care in the choice and position of the lamps and fixtures would be well repaid by the improved quality and output secured as a result. Better light, he work is the rule.

Street Lighting with Fame Carbon Arc Lamps

By P. A. Boyd.

Federal Street, North Side, Pittsburgh, is the location of the latest development in street illumination by means of long burning series flame carbon arc lamps. The accompanying illustration, taken at night, gives a fair idea only of the intense illumination produced on this thoroughfare. Not only is the street bright enough to distinguish people several blocks away, but the ornamental poles from which the lamps are hung are a wonderful improvement over the old wooden poles formerly employed.

The adoption of the new lighting system was brought about by the influence of the North Side Board of Trade, Pittsburgh. Just recently the grade of Federal Street has been raised very considerably in order to place it above the flood level. Now with the street in a much better condition than previously it was decided to complete the improvements with

an up-to-date and efficient lighting system. The above system is the result of this determination.

After a thorough investigation a new flame carbon arc lamp, recently placed on the market, was adopted. This is the same lamp that was used to illuminate the hall at Baltimore where the National Democratic Convention was held, and concerning which so much has been said. The illumination of this hall was such that the chairman had no difficulty in recognizing delegates in any part of the building when they arose to speak.

There are installed 90 lamps in all, each with the commercial rating of 3000 candle-power. The street is 48 feet wide and the lamps are placed 60 feet apart. They are hung on ornamental poles of Colonial pattern, 25 feet high, with ornamental goose necks. Federal Street is now well lighted.



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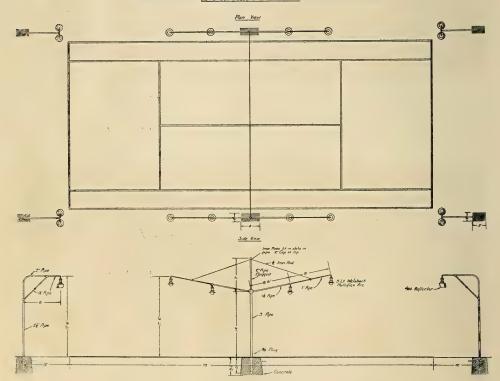
Playing Tennis at Night on Courts Lighted by Gas Arcs

By T. I. LITLE, JR.

Experiments have been conducted over a period of several months to determine whether or not it would be practical to play lawn tennis at night on courts lighted by gas illuminates. These experiments have culminated in an installation where four tennis courts are lighted at the

the general membership; consequently, where single courts have been lighted, it is found that they are used but one evening a week for tournament Where more than one court is lighted the illumination becomes more economical, as the light over one court contributes to the

DIAGRAM OF PIPING FOR NIGHT TENNIS ILLUMINATION USING SLT. WELSBACH MULTIFLEX ARC



Woodbury Country Club, Woodbury, N. J., the gas being supplied by the Public Service Gas Company.

The lighting of a single court would not be adequate for a country club, because so few of the club members could take advantage of the court during the evening; therefore it could not be considered popular from the stancpoint of illumination of the adjoining courts. Where several courts are lighted, the

game became very popular.

The lighting of single private tennis courts, however, is perfectly feasible. It must be borne in mind that to produce the same illumination with any illuminant other than gas, the cost would be several hundred per cent. greater.



DAY VIEW.



NIGHT VIEW.

It has been found at Woodbury that the courts are patronized on an average of three hours an evening, with all courts filled, and a number on the waiting list. A number of players interviewed declared that they enjoyed night tennis immensely more than day tennis for the reason that in the cool of the evening they did not become so easily fatigued. From the social standpoint it can be considered an instant success to any club adopting it. There are a large number of automobiles parked along the courts every night watching the game. Tennis is becoming very popular in America; so much so that it becomes difficult for the average business man to enjoy the game even on Saturdays and holidays, the courts being in such great demand, and it was with the idea of remedying this situation that night tennis was considered.

The nominal charge of 10 cents per hour per player will more than take care of all expense incidental to the operation of the lamps.

Total for two courts for 1 night......\$1.77
Revenue from two courts for 1 night:
8 players—3 hours @ 10c. per hour.....\$2.40

When the proposition of supplying gas for night tennis was put up to the Public Service Gas Company they agreed without a moment's hesitation to run over 200 ft. of 3-in. main, realizing that here was a new use for gas which promises to be very popular before the end of the present season.

The night photograph shows the remarkably high and uniform illumination obtained. In taking the picture it required but 1½ minutes exposure on a very dark night, by the light of the lamp alone. The installation is designed to include standard material both in lamps and piping. Any pipe shop can turn out the work promptly. The installation shown in the photograph was made in two days, all the pipe being cut in the pipe shop and the poles being assembled and erected on the ground.

It will be noted that, with the exception of the pole alongside of the net posts, there are no poles near the side lines, the mast arms extending far out from either side of the central poles taking the place of objectionable side poles. Installations can be made by following the instructions in the accompanying diagram.

As shown, the poles are made up of standard pipe imbedded in concrete, each pole extending 3 ft. below the surface. The gas is taken into the pole I ft. below the surface, leaving a 24-in. drip at the base of each pole. A plug outlet is located at the ground level so that a rubber hose may be inserted for pumping out the drips on each pole. The pipe line is, of course, dripped to the meter, which is located in the basement of the club house about 100 ft. from the court. The posts are painted white, to match the white and gold five-burner gas lamps with which this installation is equipped. Lamps are all hung on ball joints, which insures them hanging perfectly vertical and which are found by experience to absorb vibra-

It will be noted that 16 lamps are required to light a single court, but where the courts are immediately alongside of each other the number of lamps may be greatly reduced, as follows:

court, 16 lamps, gas consumption 288 cu. ft. per hr.
 courts, 24 lamps, gas consumption 432 cu. ft. per hr.
 courts, 32 lamps, gas consumption 576 cu. ft. per hr.
 courts, 40 lamps, gas consumption 720 cu. ft. per hr.

In the installation shown above only two courts out of four were to be lighted, but when the installation was made it was found that the entire four courts could be used, the center two courts, of course, being better illuminated.

It must be apparent to any one that night tennis by gas light is an extremely attractive proposition to the gas man. It brings gas lighting into prominence and as such is valuable publicity advertising. There are hundreds of country clubs located in or near the large cities and suburban towns that will be interested in night tennis.

Battle Creek Streets are Well Illuminated— There's a Reason

By W. E. UNDERWOOD

The loyal citizens of Battle Creek, Mich., are still hoarse as the result of a gala night decreed for the inauguration of their new ornamental street-lighting system of two hundred lamps. This step forward places Battle Creek in the front rank of well-lighted American cities.

Electrical energy and maintenance of the installation are being furnished by

the city.

There are 150 five-lamp standards, the majority of which are located in the commercial section of the town, and fifty three-lamp standards situated in the strictly residence district. The five-lamp standards are of the four-arm type, having one

40-watt tungsten lamp suspended from the extremity of each arm and one 60watt tungsten lamp mounted on the top of the central column and above the plane of the arms. The three-lamp standards are similar to the five-lamp standards, but have only two arms. Each lamp is inclosed in a translucent spherical globe.

Standards were erected along the edge of the curb in the business district, at intervals of 70 ft. A trench, the width of half a brick, was made along the curb and lead-covered steel tape cable laid, the lamps being connected on the multiple system. In the residence section the standards were staggered at intervals of 125 ft.



FIG. I .- LIGHTING OF BATTLE CREEK RF DENCE STRE!

TECHNICAL

A Study of Natural and Artificial Light-Distribution in Interiors

By M. Luckiesh.

(A paper read at the sixth annual convention of the Illuminating Engineering Society, Niagara Falls, Ont., September 16-19, 1912.)

Introduction.

The ultimate goal of the illuminating engineer is the production of a system of lighting which will combine high efficiency with good esthetic effect and proper hygienic conditions. Many are wont to go to nature for examples of good lighting led by their belief in the assumption that as the eye has evolved under natural outdoor lighting there will be found in nature that which pleases and yet produces the minimum of eye-strain and resulting physical discomfort. To what extent that assumption is justified is an open question. However, it is of interest to compare natural lighting with the attempts that have been made to imitate it in the design of artificial lighting units and installations, and also with those more common installations which make no pretense of imitating nature's lighting.

The distribution of light in nature varies enormously with time and place. Overcast days are quite unanimously considered unpleasant and depressing owing largely to the absence of shadows. Sometimes dark ceilings have been erroneously likened to an overcast sky, when as a matter of fact the latter more nearly resembles the condition of indirect lighting. An overcast sky is nearly always brighter than a deep blue sky and presents a higher brightness than the objects illuminated by it. Overcast days being unquestionably unpleasant, there remains the bright sunny lay to be considered. A certain scene in na ire will not appear equally pleasant throughout a day. Long and ill-defined

shadows seem to be necessary to produce a pleasing effect. In a previous study 1 of the distribution of luminosity in nature this point was very apparent. Another point brought out by that investigation was the fact that the highest brightness for the particularly pleasant scenes was found somewhere in the first 45 degrees above the horizontal. The scene which is pleasant in the early and late portions of the day become depressing and unpleasant at noon when the shadows are small and

sharply defined.

On a sunny day about 80 per cent. of the light which reaches the earth comes directly from the sun, while the remaining 20 per cent, comes from the sky. In other words, 20 per cent. of the outdoor light on a clear day is diffused light. This proportion varies with the clearness of the atmosphere. If one chooses to copy these conditions, but by no means does the writer advocate it, a semi-indirect unit should be employed, but the unit must send 80 per cent. of the useful light directly to the working plane, leaving 20 per cent. to come via the ceiling and walls. This is not the case with any of the semiindirect units in use at the present time. In fact, the ratio of diffused light to direct light is more than reversed. A bare unit hung close to the ceiling more nearly approaches nature's lighting under a clear sky with the sun unobstructed than any other system. In a room so lighted short

¹ Distribution of Luminosity in Nature. Ives & Luckiesh, Trans. III. Eng. Soc., vol. vi, p. 687, October, 1911.

and long shadows will be found. In fact, in a room of moderate size lighted by a direct diffusing unit in the center the condition immediately beneath the unit resembles mid-day in nature, while near the walls will be found the longer shadows of the later afternoon. Certain direct lighting units then more nearly approach this condition of nature's lighting than either the indirect or semi-indirect units.

It has been said that indirect lighting goes to the other extreme and reproduces the conditions obtaining on an overcast day. This is not accurately true for the light from the upper walls and ceiling is

more or less directed.

While it is well to bear in mind the distribution of light in nature, it will be of interest to compare indoor natural lighting with artificial lighting under various conditions. Several representative rooms were chosen for this purpose, and various unusual measurements were made with the hope of obtaining more complete data than are usually furnished by measurements of illumination on a horizontal plane.

Illuminating efficiency is frequently defined as the ratio of the effective lumens on a horizontal test-plane to the total lumens generated. While this ratio gives the illuminating engineer valuable information, it certainly does not measure illuminating efficiency under all conditions. "illuminating efficiency" The term should take into account not only the amount of light which reaches the test plane, but also the manner in which that light gets there. The distribution of light flux about a point in space is quite an important matter. The illumination on a small plane area in a certain position at that point may be due to light coming from a point source, or it may be due to light reaching the small area from many directions. The useful value of a footcandle on the plane will differ in the two cases. At least this holds true in many operations for which light is used. While there is disagreement as to the brightness of walls relative to the ceiling, there is a general agreement that diffused light is necessary for proper illumination. course the degree of diffusion advisable is another open question; however, it should be possible to establish some method of measuring illumination which involves

the diffusion factor. Perfect diffusion obtains in an Ulbricht sphere, while the other extreme is produced by a point source of light amid dark surroundings. Perfect diffusion is approached in a room with ceiling, walls and floor covered with the same light-reflecting material, with the direct light screened from the point in question. Illuminating efficiency will be discussed later.

DIFFUSION OF LIGHT.

The question now arises, What is meant by diffusion? The term, diffused light, is very frequently used to define that light which reaches the working plane or point indirectly-via ceiling, walls, etc. The ratio of the indirect to the total light will be termed the percentage of diffused light. In determining this factor one is concerned with the nature of the light sources because the direct light must be screened from the photometer. This is easily done with direct units, although various results will be obtained, depending on the position of the screen relative to the lighting unit and to the photometer. In indirect lighting if only the direct light is screened from the instrument the percentage of diffused light would be 100 per cent. If the secondary sources are considered as emitting direct light (and the light from the ceiling is more or less directed) then with this light screened off the percentage of diffused light would be very small. This is well illustrated in data to be referred to later. Obviously the position of the screen again influences the results.

It is often desirable to view various sides of an object, hence the distribution of light about the object is of interest. A factor which is a measure of the uniformity of distribution of light through a point in space might be termed the degree of diffusion of light at that point. This could be determined by rotating the tube of a Sharp-Millar photometer about the point measuring luminous intensity in all directions. This quantity would be difficult to measure in practise, and is not as important as the following one.

A quantity somewhat akin to the foregoing, but of greater moment in the practical use of light, is the uniformity of 13he distribution of illumination about a point. This can be determined by measuring the illumination with the photometer diffusing glass placed at the point and perpendicular to various directions. It would, of course, be impractical to measure the illumination in all directions, but a compromise can be made by measuring the distribution of illumination in various planes.

Shadows, of course, are important, being necessary in some cases and annoying in others; but they have not been given much attention in this paper excepting those on the test plane or at the test points. When shadows are sharp the cause is commonly attributed to lack of "diffusion" and this again brings forth the question, What is meant by diffusion? It indicates that there is an undesirable looseness in the use of certain phraseology.

The character of the shadow primarily gives an accurate idea of the character of the light source and an indication of the degree of diffusion at the point in quesa shadow. By the character of the shadow gives an accurate measure of the percentage of diffused light under that particular condition. In fact this factor was determined by measuring the brightness of a diffusing surface in and out of the To further illustrate these shadow. quantities imagine a small object casting a shadow. By the character of the shadow the lighting system is recognized, and by its relative brightness the percentage of diffused light is determined, while the uniformity of illumination on various planes about the object is obtained only by actual measurement of the distribution of illumination about the point in question. A white perfectly diffusing sphere placed at any point would give an accurate representation of the latter quantity by the distribution of brightness on its surface.

DESCRIPTION OF TEST ROOMS.

In this investigation the general character of natural indoor lighting was studied in comparison with artificial lighting under various conditions. Besides studying the distribution of light in various planes some measurements were made

he distribution of brightness, and the pentagy of elective ly nens incident on a horizontal t plan. Measurements

were made chiefly in three rooms. The dimensions of these rooms and other data are given in Fig. 1. Room 1 was on the first floor and was lighted through three windows in the south side of the room. The lower portion of the window was covered with dark curtains. A low three-story building was distant about 100 feet (30.48 m.), obstructing the sky up to about 30 degrees above the horizon. A portion of the sky was visible from all stations on the 36 in. (0.914 m.) test plane, which was the plane used in all measurements of horizontal illumination. The ceiling was light cream in color; the walls were covered with dark green burlap, and on the floor was a dark green carpet. The reflection coefficients of ceiling, walls and floor were of the order of magnitude of 40 per cent., 10 per cent, and 7 per cent., respectively. The woodwork was dark. By natural light the room was quite pleasant. It was lighted artificially by a fourlight fixture with prismatic spheres (containing 25-watt tungsten lamps) in the center of the room, the lighting units being 2 feet, 6 inches (0.762 m.) from the ceiling.

Room 2 was quite different. It was lighted by windows on two sides-two on the east side and one on the north side. On side B was a low one and a half story building about 35 feet (10.668 m.) distant, while the sky was obstructed very little on side A. The ceiling and walls were cream colored, light green linoleum covered the floor, while a wainscoting 4 feet (1.219 m.) high encircled the room. The reflection coefficient of walls and ceiling was approximately 40 per cent., while that of the floor was 8 per cent. This room was lighted artificially during the tests by a four-light fixture, with intensive prismatic reflectors containing 40watt tungsten lamps, and also by an indirect unit, both of the latter fixtures being in the center of the room. Direct light from the indirect unit was incident on the walls to a point about I foot below

Room 3 was a long, narrow room on the second floor with one large window on one side. The sky was quite unobstructed. The walls were of light-finish wainscoting and the ceiling was white. It

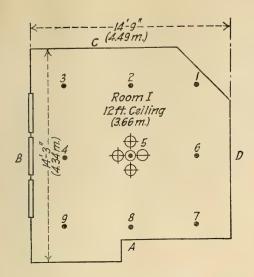


FIG. 1a.-PLAN OF TEST ROOM.

was lighted artificially by means of three units, which were spaced as shown in Fig. 1. These units consisted of 100-watt tungsten lamps in intensive prismatic reflectors.

Distribution of Illumination in Vertical Planes.

A Sharp-Millar photometer was used in the usual manner—the light being incident on the diffusing glass plate. The right-angled tube supporting the glass

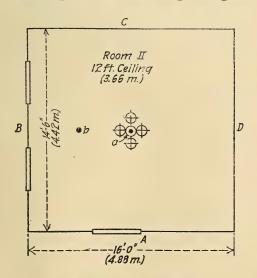


FIG. 2a.—PLAN OF TEST ROOM.

plate was rotated through 360...degrees and measurements of illumination were made every 15 degrees. By this means the diffusing glass plate was presented perpendicularly to 24 different directions in a vertical plane. This arrangement did not permit of rotation of the light-receiving glass plate around an axis in its own plane as might have been preferred. Instead it rotated about an axis parallel to its plane and about five inches (12.7)

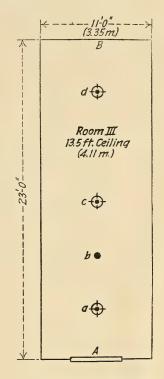
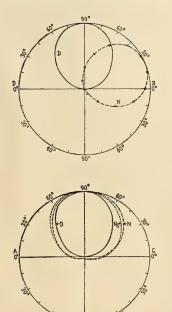


FIG. 3a.—PLAN OF TEST ROOM.

cm.) distant. For daylight measurements very clear or uniformly overcast days were chosen owing to the necessity for constant intensities. In no case did very much direct sunlight enter the rooms during the measurements, so that there was no appreciable difference in light-distribution on clear and overcast days. The variable nature of daylight makes it necessary to work rapidly even on days when the intensity seems to be quite constant.

Fig. 2 shows the distribution of mination about a point in the cen Room 1, 36 (0.9)...) from the

floor. The vertical plane in this case was BD, which intersected the sides B and D. The circles indicate the distribution with the light cream shades drawn. In order to make the interpretation of the polar curves easier, it should be explained that any radius-vector represents the relative illumination on the diffusing glass when placed at the origin and perpendicular to the radius-vector and to the plane of the paper. The data throughout the paper is relative. In all cases N indicates natural light, while D and I indicate direct and indirect artificial lighting respectively. The results obtained in the other plane (AC) are shown in Fig. 3. As is to be expected, in this case there is a greater uniformity of illumination about a point in a vertical plane with natural lighting than with direct artificial lighting. distribution of illumination in a vertical plane about the test point has been plotted in all cases with the same maximum, and from the curve an idea of the various fac-



FIGS. 2 AND 3.—DISTRIBUTION OF ILLUMINATION
IN THE CENTER OF ROOM I IN TWO DIFFERENT PLANES. (N INDICATES NATURAL
LIGHT, WHILE D AN VOICATE
DIRECT AND INDIRECT LIGHTING, RESPECTIVELY.)

tors discussed under the foregoing heading can be obtained. An empirical quantity, which will be termed the illumination uniformity factor, will be used to compare the distribution of illumination about a test point in a certain plane for various systems of lighting. The method of obtaining this factor is purely empirical and for lack of a better method it will be considered as the ratio of the mean illumination about a point in one plane to the maximum illumination.

If the small revolving surface on which the illumination is measured is illuminated by a point source the average illumination on the small revolving area will

be $\frac{1}{2}$ times the maximum. If the test point receives light in equal quantities from all directions, the illumination uniformity factor on the same basis will be unity. Then the lowest value this factor can have is that due to the illumination from a point source which equals 0.3183. The uniformity factors in vertical planes parallel to the walls of the rooms have been determined in this empirical manner and are presented with other data in Table 1, which is a summary of the data shown in Figs. 2 to 9. (This data will afford a means of calculating the above factor in several other ways if desired.) The average illumination on the test plate in its 24 positions, when rotated about an axis perpendicular to the plane under consideration is, in terms of the maximum, equal to the so-called illumination uniformity factor. The average illumination in foot-candles can be obtained by multiplying the illumination uniformity factor by the maximum value in foot-candles. The degree of diffusion of light at any point in space differs from the factor just discussed in that if the point receives light from a point source the degree of diffusion would be zero.

While the adopted method of plotting the distribution of illumination is advantageous in indicating the illumination uniformity factor and the direction of the light, it does not show clearly the exact magnitude of various important factors such as upward light and minimum illumination. To give an idea of the relative values of these latter quantities, the data

in Fig. 4a (referred to later) is plotted in a different manner in Fig. 4b. Tables I and 2, presented later, also give an idea of these values.

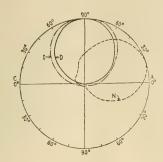


FIG. 4A.—DISTRIBUTION OF ILLUMINATION IN A PLANE IN THE CENTER OF ROOM II.

The data obtained in Room 2 are shown in Figs. 4a, 4b, 5, and 6. The uniformity factor is greater with the indirect system than with the direct system, and, as was expected, in such a room natural lighting compares favorably with indirect lighting in this respect. Too often, it is assumed, that natural light indoors is very diffuse when as a matter of fact it is quite directed. Figs. 4a (also 4b) and 5 show

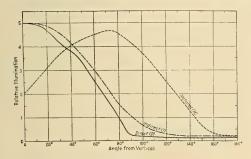
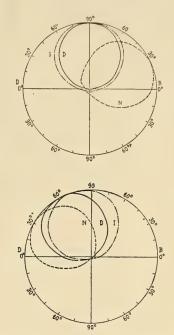


FIG. 4B.—DISTRIBUTION OF NATURAL, DIRECT AND INDIRECT ILLUMINATION IN ROOM II.

the distribution of illumination in the vertical planes BD and AC, cutting the sides B and D and A and C, respectively. The photometer test plate was in the center of the room 36 inches (0.914 m.) from the floor. The data shown in Fig. 6 was obtained with the photometer test plate at station b (side center), Fig. 1. It will be noted that the areas inclosed by curves D and I have increased at station

b while the area of N has decrease. This increase in area of D and I seemed always to be the case for station nearer the walls. Likewise, there was usually a



FIGS. 5 AND 6. DISTRIBUTION OF ILLUMINATION
IN TWO VERTICAL PLANES IN ROOM II.

greater percentage of diffused light near the walls of a room lighted from a central fixture than in the center of the room.

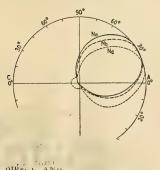
The variation in the distribution of daylight illumination in a vertical plane perpendicular to the window is shown for three stations (a, b, d, Fig. 1) in Room 3 in Fig. 7. Na represents the condition at the station (a) nearest the window, while N_d was obtained at (d) at the extreme end of the room. As would be expected, the general direction of the light is more nearly horizontal as the distance from the window increases. The reflection from the adjacent wall is apparent in N_d. This reflection adds considerable diffused light. In Fig. 8 is shown the distribution of direct artificial illumination at three stations (a, b, and c, Fig. Considerable difference in the area of curves is ap ... t. Station b, between the lighting units, shows a more desirable distribution of light than Station a, directly Station was in the cent of m. Of call it was noted the eillumination uniformity factors.

Station was in m. Of call it was noted the eillumination uniformity factors in the cases of smaller uniformity factors.

It was thought desirable to attempt to imitate with artificial light the natural distribution of light in one of the rooms. For this purpose room 2 was chosen. Frames covered with diffusely reflecting white cardboard were inserted in the window openings and these were illuminated by means of a specially designed reflector held from the wall at the upper part of the dummy window by means of a bracket. The reflectors were so adjusted as to give approximately the same relative distribution of brightness on the imitation window as obtained by natural light. Of course the approach to natural conditions in this respect was only approximate because in natural lighting the distant sky was the principal source of light, while in the artificial case the dummy windows became the light-sources. Measurements. however, showed the distribution of light in the room to be about the same as obtained under natural lighting conditions. The effect of this arrangement was satisfactory. There was also an indication of the possibility of as high an efficiency being obtained by this method of indirect lighting as by the ordinary overhead indirect systems. Further study along this line is proposed.

ILLUMINATING EFFICIENCY.

It seems that some better method of comparing different systems of illumina-



ING, RESPECTIVEL, "MINA-

tion should be devised. The percentage of total generated lumens that are "effective" on a horizontal plane does not necessarily measure illuminating efficiency. In other words, one lumen on a small horizontal area probably equals another lumen on the same plane in illuminating value only when the light in the two cases comes to the plane in the same manner. While there are several questions, such as brightness of walls and spectral character of light, involved in the question of illuminating efficiency, the matter of diffusion is of considerable importance. The amount of diffusion necessary for good

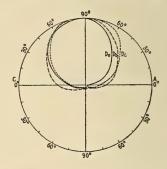


FIG. 8.—DISTRIBUTION OF DIRECT ARTIFICIAL ILLUMINATION AT THREE STATIONS

IN ROOM III.

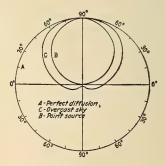


FIG. 9.—DISTRIBUTION OF ILLUMINATION IN A
VERTICAL PLANE ABOUT A POINT UNDER
THREE CONDITIONS OF LIGHTING.

lighting will, perhaps, long be a subject for disagreement and may never be exactly expressed mathematically, but it is possible at once to place this value between two limits, namely, no diffusion, as from a point source, and perfect diffusion as obtains in an Ulbricht sphere under proper conditions. In Fig. 9 curves are plotted showing the distribution of illumination in a vertical plane about a point under three conditions of lighting. The large circle A represents complete diffusion, while curve B shows the distribution of illumination due to a point source. In this latter case the point source was 8 ft. (2.438 m.) from the diffusing glass of the photometer and stray light was carefully eliminated. Curve B should be a circle, but it is not, owing chiefly to the fact that the diffusing glass reflects somewhat specularly, and very slightly to the manner of rotation of the diffusing glass. The latter is not rotated about an axis in its plane and hence the angle of incidence of the light is exaggerated. Curve C shows the results obtained on the roof of a high building on an overcast day. The sky was unobstructed above the horizontal plane through the diffusing glass and the roof was very dark, so that little light was reflected from it. The sky was about

tested e pt in the system of direct li com 3 it stem shows a very much greater up than daylight from a single ge window.

Effective Lumens on a Horizontal Test-Plane.

Owing to the manner in which daylight enters a room through the windows, it is of interest to determine the percentage of effective lumens incident on the working plane. On account of the fact that none of the light which directly reaches the test-plane strikes it normally a high efficiency in this respect is not expected. Some of the light which enters the room strikes the walls and floor and is reflected and re-reflected before it finally reaches the plane. A study of the data obtained reveals the fact that the percentage of diffused daylight in interiors is of about the same order of magnitude as the dif-

		TABLE I	-SUMMARY FOR	FIGS. 2 AND	9.		
					Min. f. c.	Illumination uniformity	Relative areas
		Maximum	Minimum	Average	Max. f. c.	factor	enclosed
		foot-	foot-	foot-	per	Aver. f. c.	by polar
Fig.	Curve.	candles.	candles.	candles.	cent.	Max. f. c.	curves.
2	D		0.07	0.72	3.4	0.326	61.0
	N	. 46.3	0.03	15.3	1.0	0.331	65.5
3	D	. 2.2	0.08	0.71	3.4	0.323	60.8
•	N	. 21.7	0.50	7.8	2.3	0.359	80.0
	Ns	. 2.9	0.07	1.04		0.360	80.6
40	D	. 4.9	0.12	1.60	2.5	0.327	64.0
	I	. 2.8	0.11	0.98	3.8	0.350	75.0
	N	. 29.6	0.84	10.53	2.8	0.356	74.3
5	D	. 4.9	0.12	1.62	2.5	0.330	64.0
	I	. 2.8	0.11	0.98	3.8	0.351	74.6
	N	. 22.0	I.2	7-74	5.5	0.352	68.5
6	D	. 3.6	0.10	1.22	2.8	0.340	67.5
	<u>I</u>	. 2.I	0.06	0.73	3.0	0.357	76.5
	N	. 20.0	1.0	6.8	5.0	0.340	64.3
7	Na		3.9	74.75	1.7	0.329	64.0
	Nb	. 82.0	0.83	26.86	· I.0	0.328	61.0
_	Nd		2.0	7.8	9.0	0.343	63.0
8	<u>D</u> a	. 2.8 .	0.14	0.96	5.0	0.344	69.0
	\mathbb{D}^b	. 2.2	0.16	0.83	7-3	0.376	82.5
	Dc	. 3.1	0.18	1.10	6.0	0.358	78.5
9	A			• • •	I.O	1.000	276.5
	В				0.0	0.378	59.5
	С					0.381	90.0

three times as bright at the zenith as at the horizon. This fact shows that even a greater illumination uniformity factor (indicated roughly by a greater area inclosed by the curve) would be obtained from a uniformly bright hemisphere. The areas of all the curves are given in Table I. It will be noted in some cases that the daylight curves inclose a smaller area than the direct artificial light curves. Indirect lighting showed the greatest illumination uniformity factor in all cases

fused light under artificial lighting conditions. The method of obtaining the percentage of effective lumens on a horizontal plane was to determine the total lumens entering the room and the total lumens incident on the very plane.

Let A_1 , A_2 , A_3 , etc.

E₁, E₂, tion in f respectively that than Station a, dicandles on the horizo il test plane. Some Comparative Results in the A' = area of test plac in square feet. Then

_001 X $A_1E_1 + A_2E_2 + A_2E_2 + \text{etc.}$ = per cent. "effective" lumens on a horizontal plane.

THREE ROOMS.

In Table II. are shown various data which give some idea of the distribution of light under various conditions. The ratio of the brightness of a shadow cast upon a diffusing surface to the brightness

	TABLE	II.—COMPARATIVE ILLUMIN	NATION RESU	ILTS IN THE THREE	Rooms.	
Room.	Station.	Lighting.	Per cent. diffused light (I /Ih)	Ratio of Max. on vertical planes to Ih Per cent.	Ratio of Min. on Max. four vertical planes. Per cent.	Ratio of upward to downward illumi- nation. Per cent.
~		D		9.3 215.0	40.0	3.4
I	(Center)	N (Shades)	27.8	240.0	7·5 6.7	4.7
	1	D	15.8	58.0	6.8	2.4
I	5	Ñ		183.0	7.0	5. I
	(Side center)	N (Shad		333.0	10.0	
		D	5.7	3.6	80.0	2.5
II	Center	Ī	6.2	17.5	86.0	2.5 3.8 8.5
		N	5.5	207.0	5.3	8.5
		D	14.0	50.0	16.2	6.2
II	Side c nter	I		34.5	43.0	3.0
		N	- 33.7	183.5	6.6	6.4
III	a	D	5.8	23.5	16.4	5.0
		N	2.3	192.0	2.6	5.7
III	b	D	5.4	43.0	14.9	7-3
		N	8.0	278.0	2.8	15.2
III		D	17.9	26.6	79.0	6.0
		N	13.7			
III	d	D		22.0	21.0	5.8
		N		388.0	8.4	33.3

The average illumination on the window was determined both by means of the Sharp-Millar photometer and a special arrangement of a diffusing glass and mirrors. This arrangement consisted of an elbow tube of 8 in. (20.32 cm.) square cross-section with a diffusing glass in one end and a mirror in the angle of the elbow. The end containing the diffusing glass was placed against the window pane and its image was reflected downward The brightness was by the mirror. meas red with a photometer in its natural posit in and the mean illumination on the window was determined. Room I, with dark walls and with windows only on one side, had 17 per cent. of the total lumens entering the room incident on a horiz ntal play 35 in (0.914 m.) from the flor.

Room 2 with light walls and with windows on two sides showed 33 per cent. of the total entering lumens to be incident on the test plane. With the direct lighting system the lumens on the same test plane in room I amounted to 30 per cent. of the total generated, and 35 pe ant. in room 2.

of the surface under the total direct and reflected light was determined at various stations. This factor I, was actually obtained by casting a shadow which just covered the diffusing plate of the photometer. The object which cast the shadow was of constant size, but its distance from the diffusing glass varied. It is evident that the percentage of diffused light as measured in this manner varies with the distance of the object which cast the shad-

cw. This value $\frac{I_s}{I_H}$ (I_H = illumination on a horizontal plane outside the shadow) is a correct value of the percentage of diffused light only for that particular condition under which it was obtained. To obtain the true value, or more nearly so, the direct light should be screened nearer the light-source. Obviously this would be difficult and impracticable with indirect or natural indoor lighting. Attention is again directed to the distinction between diffused light as used here on a horizontal plane and degree of diffusion about a point as defined in the first part of the paper. The percentage of diffused light under artificial conditions as obtained by

the above method compares favorably with that under daylight illumination. With direct lighting the shadows becomrelatively less dark near the walls of the room when the latter is lighted from a central unit. This would not be as marked when the illumination of the test plane is quite uniform. The true or maximum percentage of diffused light is more nearly a constant value throughout a horizontal test plane. In Room 3 the percentage of diffused light rapidly increases with the distance from the window for natural lighting.

Illumination measurements were made with the test plate 36 inches (0.914 i from the floor and parallel to the walis. The ratio of the maximum of these four readings to the illumination on a horizontal plane is shown in the next column. The figures illustrate a great difference in interior lighting by natural and artificial methods. The next column shows the variation in illumination on the four vertical planes just described. Natural lighting is inferior in uniformity in this respect and indirect lighting shows the greatest uniformity. As is well recognized, extended sources produce less annoying shadows in most cases, but it must not be supposed that extended sources such as a patch of sky through a window do not give fairly sharp shadows under many conditions. Another reason for the use of extended light sources of low brightness is found in the elimination of glare from objects such as polished metal and especially glazed paper.1

The ratio of upward to downward light was determined by pointing the photometer tube with diffusing plate first downward and then upward, measuring the illumination in each case. This ratio is of little or no importance in such a case as desk lighting, but it becomes of greater moment in many industrial operations. While no elaborate study of this feature has been attempted, some data will be presented which will further illustrate the great difference in the distribution of light under natural and artificial interior lighting conditions. In Table II. is shown the ratio of upward to downward illumina-

tion at v. stations, the test plate being 36 inche 0.914 m.) from the floor. With artificial systems the upward light is but a few per cent. of the downward light, while this ratio is much greater with natural lighting, as is evident from the curves in Fig. 10, which were obtained in the center of Rooms 1 and 2. It is evident that the height of the test plane, area of sky exposed, reflection from the ground. buildings, and especially from snow, affect this ratio. Under practical conditions this ratio for natural lighting will nearly always be much greater than that for artificial lighting. This should be of considerable importance in many cases, especially in industrial lighting. From Table II. it will be noted that this ratio increases steadily for natural lighting as the disance from the window in Room 3 is inci ased.

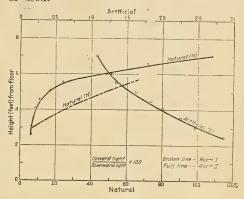


FIG. 10.—RATIOS OF UPWARD AND DOWNWARD
LIGHT, WITH NATURAL AND ARTIFICIAL
LIGHTING OBTAINED IN THE CENTER
OF ROOMS I AND II.

DISTRIBUTION OF BRIGHTNESS.

From both the esthetic and lygienic standpoints the distribution of brightness is of considerable importance. In a previous study it was found that for pleasant conditions the brightest point in the field of vision was some he above the horizontal. While there in our nimous agreement as to the relative effects of light and dark walls on fatigue and eyestrain, it may prove of interest to show the distribution of brightness under natu-

¹ M. Luckiesh, "An Analysis of Glare from Paper," Elec. Rev., June 1, 1912.

¹ Loc. cit.

ral and artificial lighting in two rooms one with light walls and the other with dark walls. In both cases the reflection coefficients of the ceilings were of the same value. The brightness readings were made with the illuminometer with the diffusing glass removed.

In Room I, with dark walls and floor, the brightness readings were taken in a vertical plane AC parallel to the window. In Fig. 11 are plotted the results with direct and natural lighting. The abscissae represent angles between the vertical and the axis of the photometer tube, which was in the center of the room 36 inches (0.914 m.) from the floor. In spite of the difference in direction of the natural and direct artificial light there is a close resemblance in the brightness distribution in the two cases.

The results obtained in Room 2, plane AC, are shown in Fig. 12. It will be remembered that this room had a light ceiling, and walls with windows on two sides. Here, again, there is a striking resemblance between natural and direct artificial interior lighting. The brightest area in the room under natural lighting conditions is on the side walls near the horizontal line of vision. This is generally true with light colored walls illuminated by daylight through windows. This fact is worthy of the attention of those who condemn light walls.

In the foregoing measurements of brightness the light sources were left out of account assuming that in a properly lighted room no brilliant sources would be permitted in the field of vision. Of course

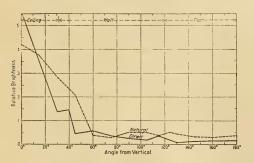


FIG. II.—RESULTS OF BRIGHTNESS READINGS
TAKEN IN A PLANE (ROOM I) PARALLEL TO
THE WINDOW WITH DIRECT AND
NATURAL LIGHTING.

the brightness of the sky and the artificial lighting units employed are usually many times greater than the surfaces which they illuminate and could be plotted on no reasonable scale with the other data. It

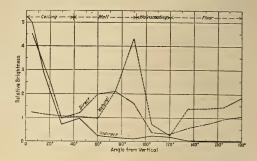


FIG. 12.—RESULTS OF BRIGHTNESS READINGS
TAKEN IN ROOM II WITH DIRECT AND
NATURAL LIGHTING.

might be possible that the light sources even though out of the range of normal vision play an important part physiologically and psychologically.

While on the subject of brightness it might be well to call attention to the relative brightness of objects commonly associated. The following values are only roughly approximate:

Sun at zenith
Blue sky
Sun at 5 deg.
Blue sky
Sun at zenith
Bright cloud
Bright cloud
Blue sky
Tungsten filament
Bright ceiling
Frosted tungsten lamp
Overcast sky
Brightest object in room

Conclusions.

While the rooms studied were representative of general types not many conclusions will be drawn. The writer prefers to present most of the results of the investigation merely as data to be interpreted by the reader as he sees fit. A few conclusions, however, appear justifiable.

The measurement of illumination on a

horizontal plane does not give a fair comparison of illuminating efficiencies. The distribution of illumination in various planes is of considerable importance when comparing various systems of lighting. A careful distinction is made between the percentage of diffused light and the degree of diffusion of light about a point.

The areas inclosed by the polar curves of illumination distribution in a certain plane roughly indicate the uniformity of illumination in that plane about the test point. When these curves are plotted to the same maxima a rough comparison of these uniformity factors can be made. An empirical method of calculating this factor has been used, but the author realizing that this is merely a matter of opinion has presented the data in Table I, from which it is possible to make calculations on a different basis if desirable.

The uniformity of the distribution of light about a point under natural lighting conditions in interiors is not as great as is sometimes assumed, and is often less than that obtained by direct or indirect lighting. Unless the room has windows on more than two sides it is likely that indirect lighting will always show a greater degree of diffusion and a greater illumination uniformity factor about a point than natural interior lighting.

While extended sources assist in diffusing light, even a greater illumination uniformity factor is obtainable by a distributed direct system. Extended sources are advantageous in eliminating sharp shadows and glare from glazed paper and polished objects.

The great difference in the ratio of upward to downward light for natural and artificial lighting may partly account for the greater desirability of the former in many cases, especially in industrial lighting.

Daylight entering a room through windows is, to a considerable extent, incident upon the walls producing a distribution of brightness more nearly that obtained by direct artificial lighting. At least this result was obtained in rooms of extreme types and other observations indicate this similarity to be somewhat general. Attention is directed to the fact that in rooms with light walls the brightest spot in the room under daylight illumination is usually on the wall near the horizontal line of sight.

It is possible to artificially imitate the distribution of daylight in a room with pleasing effect and with an efficiency not prohibitively low.

While more or less general information has been obtained from the investigation much of it is difficult to transmit. The work was undertaken with the view of making a general analysis of the distribution of light in ordinary rooms under usual lighting conditions.

Examining the Body with Searchlights

Inventive genius has now made it possible to look into nearly all the hollow organs of the body during life, to extract foreign bodies which have lodged there accidentally, or to explore and treat diseased conditions. Children, frequently, and grown people, occasionally, swallow or suck into the windpipe various objects, which lodge in the esophagus, or in the bronchial tubes.

The bronchoscope is a tube with a handle and mirror by means of which the surgeon can look down into the bronchial

tubes and locate such foreign bodies, and by the aid of other appliances they may be grasped and removed. A similar instrument is used for locating objects which may have lodged in the esophagus, the passage to the stomach.

An improvement on this instrument enables the surgeon, through conveniently arranged mirrors and a small electric lamp at the end, to have a view of the interior of the stomach, and he may study the condition of the lining of that organ. The bladder may also be explored.

GLARE

The defining of this too generally apparent, disturbing and destructive condition seems to be a difficult matter.

However, after all, we are more concerned in its *elimination* than in its definition.

Glare, resulting from the use of glazed (calendered) papers, and glossy inks, is much too prevalent—of this there is no doubt.

Observe the character of the paper and ink used in this issue of GOOD LIGHT-ING—and the lack of glare.

The effect is more agreeable to the eye. It is also artistic.

EDITORIAL

STANDARDIZATION

On page 313 appears a short editorial under the above title. The terseness of the editorial perhaps warrants expansion here.

When the idea involved in the application of "standardized" material is to permit the general—widespread—employment of valuable accessories—with same, as a whole, fully suited to environments—so that the user may derive real benefit, then the motive is good and commendable.

However, if the effort is made to use "standardized" material—especially if lacking in ordinary beauty—where beauty—appropriateness—is desired and necessary, without respect or consideration for the desires—verbally expressed or not—judgment *should* be exercised—and personality of the individual or establishment—then such action should *not* be supported; it should be *condemned*.

Lamp sockets, threads on fittings, sizes and physical characteristics of illuminants, certain, comparatively few, forms of reflecting and transmitting media (when considered for exposed use), gas mantles and burners, et cetera, et cetera, are made the more practical through standardization. These and other similar accessories, usually—if the proper effects are obtained—are employed as parts of the ensemble. When injudiciously used, so that their relative importance is distorted, they become unduly conspicuous, and are obnoxious.

To-day we are suffering from an epidemic of "standardization." We have carried "standardization" to the extreme. Much of our lighting equipment is without character—it being turned out much as are sausages—and ofttimes with similar degree of sameness and absence of attractiveness.

Apparently, without cognizance for requirements, lighting paraphernalia is being generally and indiscriminately applied—and ofttimes by those who claim "advanced" knowledge.

No one can dispute the fact that in these last several years conditions associated with lighting have undergone many, many decided changes—most of which have been for the better;—also that there yet remains much to be accomplished, and that the use of features underlying development of standardization—intelligent consideration and experimentation—will materially aid.

But in some instances—apparent even to the uninitiated—we have carried "developments" to an extreme. We are now about as far one way as several years ago found us the other. Let those having to do with the design and application of lighting equipment employ standardized accessories, but clothe and otherwise treat them so that character may be manifested; also that requisites will be in harmony with surroundings. Such practises will be beneficial to all concerned, and will mark a real step in advancement.

"POLICY"

So long as the present incumbent is formulating and directing the editorial destinies of Good LIGHTING, which tenancy may be of a temporary character, due to demands of his consulting practise, the policy adhered to will be:

The truth expressed without fear or prejudice.

The disregard of any influences tending to narrow the scope, duty and power of the organ that GOOD LIGHTING will shortly caused to be.

Consistency of purpose—the full recognition of all phases and conditions involved in the consideration of light, both natural and artificial.

The realization—and unmistakable expression—that a lighting installation, to be considered good, must be agreeable—not injurious—to the eye and brain; be in harmony with environments—in as "good taste" as conditions warrant and permit; employing efficient illuminants and accessories which assure economic maintenance.

Not disproportionately considering "efficiency" and "economy" as the end, producing monotonous and otherwise undesirable

conditions,—but advocating the full use of such factors as means to the desired end.

There is a considerable difference in the two indicated attitudes.

Analytical, constructive criticism,—and timely and unstinted praise for meritorious efforts and accomplishments.

Reconciliation of all interests.

The tendering of original, productive, co-operative service to Public Utilities (Central Stations and Gas Companies)—Architects, Decorators, Designers, Engineers, et cetera—and those manufacturing interests who are desirous of helping themselves by catering to the *needs* of the public.

In general, administrating equitably and intelligently to all phases concerned, breaking away from the somewhat narrowed policy which apparently has guided past efforts.

The co-operation of all is earnestly solicited to help place GOOD LIGHTING where it may wield a tremendous influence for better lighting conditions.

IMAGINATION

On another page of this issue of GOOD LIGHTING appears a short article entitled "Imagination," by Mr. Charles Ferguson, republished through the courtesy of the Cosmopolitan Magazine, in which it first appeared April, 1912.

The sentiment expressed in this brief article is so praiseworthy that we feel its further dissemination would be appreciated—and helpful. If the feeling indicated in this article could be assimilated and appreciated by those who in designing lighting installations are actuated primarily—and more ofttimes wholly—by a disproportionate appreciation for purely physical considerations, future results in lighting would be the more consistent and attractive.

Imagination—Advancement.

THE TUNGSTEN LAMP

A truly remarkable servant. An illuminant that has been made possible only after very considerable expenditure of thought, labor, time and great sums of money by lamp manufacturers. Theirs is a wonderful achievement.

But the tungsten lamp in its raw—untreated—state is ofttimes out of place if employed in an exposed manner. The color is "cold" and the effect produced, in some cases, is one of garishness.

Many kinds of work do not require any unusual treatment, but when we attempt the application of the tungsten lamp to the home, and especially in the living quarters, the light produced should be refined and made agreeable to the eye and brain.

The woman is *the* home. And woman has a love for soft, restful tones that may be obtained from the tungsten lamp by employing therewith tinted surrounding media or treating the lamp bulb with colored translucent solutions.

The amount of light obtained for energy consumed in the tungsten lamp is so great—so much more than has been possible to heretofore obtain in similar illuminants—that the slight physical loss effected by filtration to obtain desired results will be almost negligible, and more than warranted.

The lamp manufacturers have delivered the lamp—and it certainly is extremely meritorious. If the tungsten lamp be but properly *employed*, its greatness will become the more fully appreciated.

Wool shorn from the sheep's back is wool—it is the nucleus of some of our clothing; but before it finds favor with us for such purposes it must be treated so that garments manufactured from it will be satisfying to the eye, as well as being protective against the elements. The use of light may be considered in the same general category.

Let us have refinement!

ILLUMINATING ENGINEERING SOCIETY

The annual convention of the Illuminating Engineering Society, held this year at Niagara Falls, September 16 to 19, will be editorially reviewed in the October number of GOOD LIGHTING.

A review of the convention, with outline of papers, appears elsewhere in this issue of GOOD LIGHTING.

TENNIS PLAYING BY NIGHT

In our August number appeared an article descriptive of the illuminating effects produced by electrical sources as employed in lighting tennis courts so that playing might be indulged in at night.

In this issue of GOOD LIGHTING appears a somewhat similar article indicating, in this instance, the application of gas illuminants to extend the time of play.

Here, and especially in the gas light installation, we have evidence of the exercisement of ingenuity. There remains unlimited possibilities in neutralizing darkness, not only that we may work, but that we may also use such reclaimed period for recreation.

It is interesting to note that a number of players interviewed declared that they enjoyed night tennis immensely more than day tennis for the reason that in the cool of the evening they did not become so easily fatigued.

Surely, light is a truly wonderful servant when properly employed. We have yet to realize its tremendous force. Much encouragement should be extended investigators—and worth while results should be praised.

CONVENTIONS

PAST

The Illuminating Engineering Society

The sixth annual convention of the Illuminating Engineering Society was held September 16 to 19, inclusive, at the Clifton Hotel, Niagara Falls, Ontario.

Approximately one hundred and fifty persons were in attendance, of which over one hundred were members. When it is considered that there was no local membership to speak of to increase the attendance, the representation was agreeably large.

The general character of the convention was on a broader scale than heretofore evidenced; such observation being based not only on the diversified natures of the papers presented, but also in the attitude of representatives assembled.

The social features of the convention were admirably planned and executed, the committees having in charge this phase extending themselves to make members and guests thoroughly enjoy themselves. As has been the practise in previous conventions, the ladies who graced the convention were especially provided for.

The impromptu spirit of good-fellowship which prevailed among the sometimes serious-minded representatives, assisted materially in breaking down barriers, thus establishing an opportunity for a more co-operative get-together intercourse.

The local representatives, whose hospitality was chiefly responsible for the success of the convention, surely have the unstinted appreciation of the Illuminating Engineering Society as a whole, and especially those who were fortunate enough to be able to accept of such courtesy.

The convention opened Monday morning with addresses of welcome by Mr. O. E. Dores, president of the Board of Trade,

Niagara Falls, Ontario, and Mr. G. F. Nye, president of the Board of Trade, Niagara Falls, New York, the response being made by Mr. William J. Serrill, treasurer of the Illuminating Engineering Society, which was followed by President Lansingh's address, "The Value of Illuminating Engineering to Society," treating with developments, and hygienic, industrial, and æsthetic features of good lighting.

Next came the REPORT OF THE COMMITTEE ON PROGRESS, of which Dr. Louis Bell is chairman. This report, presented by Mr. George S. Barrows, dealt with recent progress and developments in the lighting industry, both in this country and abroad, the only criticism being extended was that a number of important developments had not been included.

THE REPORT OF THE COM-MITTEE ON NOMENCLATURES AND STANDARDS, chairmaned by Dr. A. E. Kennelly, was next tendered by Dr. Clayton S. Sharp. This report had to do with recommending such definitions, symbols, and terminology, necessitated by the constant development of illuminating engineering practise.

It was arranged that Dr. Charles Protus Steinmetz would open the afternoon session with a paper entitled RECENT DEVELOPMENTS IN STREET SERIES LIGHTING. Unfortunately, for the society, Dr. Steinmetz was unable to conclude certain work which would have permitted the presentation of this paper. It is understood that some section of the Illuminating Engineering Society will be fortunate in securing this paper for presentation during the ensuing year.

The gas industry was next heard from in a very interesting SYMPOSIUM ON HIGH PRESSURE GAS LIGHT-ING, being descriptive of a number of installations in this country and abroad, illustrated with stereopticon views. development in Great Britain was presented by Mr. F. W. Goodenough, chairman of the Council of the Illuminating Engineering Society, of London, Mr. Goodenough also being the controller of the Gas Light & Coke Company, of Lon-This report had to do with some 12,000 lamps of approximately 1,000 candle-power used in public lighting; also notes on industrial and factory lighting. The status of the art of high pressure gas lighting in Germany was reviewed by Mr. Oscar Klatte, manager of the High Pressure Gas Lighting Department of the Gasglulicht " Deutsche Actiengesellschaft," of Berlin. This paper, as was the one dealing with conditions in Great Britain, was presented by Mr. George S. Barrows, of the United Gas Improvement Company, of Philadelphia.

The use of high pressure gas lighting in the United States was outlined by Mr. R. N. Zeek, of the Illuminating Engineering Department of the United Gas Improvement Company, of Philadelphia.

Mr. R. F. Pierce, manager of the Illuminating Engineering Laboratories of the Welsbach Company, Gloucester, N. J., next presented an opportune paper on the DETERIORATION OF GAS LIGHTING UNITS IN SERVICE. This paper contains carefully arrived at data, which should be of considerable value to those having to do with the use of gas lighting equipment.

In the evening a delightful reception and dance was tendered by the Entertainment and Reception committees, which was largely attended by members and guests, who thoroughly enjoyed themselves.

The Tuesday morning session (September 17) was opened by a paper entitled THE METHODS OF RESEARCH, by Dr. E. P. Hyde, past president of the Illuminating Engineering Society. Dr. Hyde's paper is at once scholarly and practical, as have been all papers that Dr. Hyde has favored the Society with.

Dr. P. G. Nutting, of the National

Bureau of Standards, Washington, D. C., through his representative, Mr. Lloyd Jones, next presented a paper entitled THE DIFFUSED REFLECTION AND TRANSMISSION OF LIGHT. Dr. Nutting's treatment of this exceedingly interesting and important phase of the use of light is a valuable contribution to science, causing the Transactions of the Illuminating Engineering Society, in which the paper will be included, to become the more valuable.

HETEROCHROMATIC PHO-TOMETRY AND THE PRIMARY STANDARD OF LIGHT was next treated by Dr. Herbert E. Ives, Physicist, Photometric Laboratory, United Gas Improvement Company of Philadelphia. Dr. Ives, who has made frequent and valuable contributions to lighting literature, reviewed the problems encountered in photometry of light-sources of different colors.

Dr. P. G. Nutting, of the National Bureau of Standards, Washington, next paper entitled A NEW presented a METHOD AND INSTRU-AN MENT FOR DETERMINING THE REFLECTING POWER OPAQUE BODIES. This paper, as was Dr. Nutting's other contribution. was depicted and described by Mr. Lloyd Jones, also of the Bureau of Standards.

A STUDY OF NATURAL AND ARTIFICIAL LIGHT DISTRIBUTION IN INTERIORS, by Mr. M. Luckiesh, of the Physical Laboratory of the National Electric Lamp Association. Cleveland, Ohio, was next presented. This work has to do with the making of a general analysis of the distribution of light in ordinary rooms under usual lighting conditions, with daylight and artificial light, using direct and indirect sources, and is an elaboration upon a paper presented along similar lines, reported at the Chicago convention of the Society last One interesting conclusion indicated in the paper is that "it is possible to artificially imitate a distribution of daylight in a room with pleasing effect, and with an efficiency not prohibitedly low."

Dr. C. E. Ferree, who was to present a paper on the TESTS FOR THE EFFICIENCY OF THE EYE UN- DER DIFFERENT SYSTEMS OF ILLUMINATION, AND A PRE-LIMINARY STUDY OF THE CAUSES OF DISCOMFORT, was unavoidably prevented from presenting his paper as scheduled—to open the afternoon session of Tuesday. Dr. Ferree's paper, which was available in printed form, indicated how doctors and lighting specialists are co-operating in the study of the many-sided question of the use of light, both natural and artificial.

Dr. Percy W. Cobb, Physical Laboratory, National Electric Lamp Association, Cleveland, Ohio, through Mr. M. Luckiesh, next delivered a paper entitled VISION AS INFLUENCED BY THE BRIGHTNESS OF SURROUNDINGS. Dr. Cobb, who is responsible for many valuable contributions to the Transactions of the Illuminating Engineering Society, here further presents results of very carefully planned and executed experiments.

THE DETERMINATION OF ILLUMINATION EFFICIENCY was next considered by Mr. E. L. Elliott. Mr. Elliott's considerations had to do with a new type of photometer, which would read, instead of simply horizontal, vertical or normal intensities, the intensities of light received on other than a flat

surface from several directions.

SOME REFLECTING PROPER-TIES OF PAINTED INTERIOR WALLS was next reviewed by Mr. Claude W. Jordan, of the United Gas Improvement Company, Philadelphia. This paper had to do with an investigation made to determine the physical structures of wall surface which were painted; to secure the coefficients of reflection and general reflecting characteristics of plastered surface, painted with "dead," flat, semi-flat, glossy and highly enameled paints. Micro-photogravures were made showing the physical structure of the various wall surfaces, and a chemical analysis of the paints were made. It was found that the distribution of light diffused at the various angles changed as the percentage of pigment with reference to the vehicle (oil, varnish, etc.) was in-

Mr. E. Leavenworth Elliott then pre-

creased or decreased.

sented a paper, entitled A PROPOSED METHOD OF DETERMINING A CO-EFFICIENT OF DIFFUSION FOR LIGHTING ACCESSORIES. In this paper Mr. Elliott called attention to the insufficiency of the present methods used to indicate degrees of diffusion, setting the limits of diffusion obtainable in diffusing media, and proposed a method of obtaining the factors necessary to form a co-efficient of diffusion. In other words, making the effort to establish some standards by which diffusing media (glass, silk, etc.) could be judged so that material would be delivered to perform some definite action.

The official banquet held on Tuesday evening was in every sense most successful. Mr. Arthur Williams, of the New York Edison Company, newly-elected president of the Association of Edison Illuminating Companies, admirably filled the office of toastmaster, and his witty apropos remarks created and sustained interest throughout the four hours consumed (food was also partaken by those in attendance) by the banquet. Mr. Williams's efforts were very effectively augmented by a number of speakers, among which were Mrs. Miller and Mrs. Macbeth (a departure which proved enjoyable to those assembled, though probably somewhat nerve-racking on the ladies. Let us hope now that the precedent is established such practise may be adhere to in future similar affairs), and Messrs. Hyde, Serrill, Lansingh, Maxwell, Macbeth, Montague, Millar, Sharp, Crouse, Marks and Vaughn. The addresses, were without exception, exceedingly interesting, more than well received.

On Wednesday morning, September 18, Mr. George H. Stickney, of the General Electric Company, Harrison, N. J., presented, in the absence of Mr. C. J. Mundo, the Chairman, the report of the ILLUMINATION COMMITTEE OF THE ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGI-This report came before the NEERS. Convention as a result of the co-operative movement fostered by the Illuminating Engineering Society's Reciprocal Relations Committee, and indicate observations taken over a period of two years regarding illumination requirements for various kinds of operations in different mills. Very valuable data is given in this

report.

The next paper at this session, entitled PRESENT PRACTISE OF SMALL STORE LIGHTING WITH TUNG-STEN FILAMENT LAMPS, prepared jointly by Messrs. Clarence L. Law and A. L. Powell, proved to be of very considerable practical interest. This paper contains information which every user of artificial light would be benefited by having at his disposal. It is to be hoped that more practical papers of this type may find presentation before the Illuminating Engineering Society.

The third and last paper of this session, entitled THE ENGINEERING PRINCIPLES OF INDIRECT AND SEMI-INDIRECT LIGHTING, was presented by the author, Mr. T. W. Rolph. There is much difference of opinion as to the advantages of various systems of light distribution, and Mr. Rolph in his paper attempts to review engineering considerations entering therein.

During the afternoon business session the ladies and guests were enjoying the wonderful view afforded by a trip over the Niagara Belt Line, showing the wonders of the falls, rapids, the whirlpool, and other interesting and historic views.

The evening session, beginning at 8

o'clock, was opened by Mr. Bassett Jones, Jr., with a most interesting and convincing demonstration of COLOR VALUES OF ILLUMINATED SURFACES. This meeting was attended by members and guests, including the ladies, and very considerable enthusiasm was aroused by Mr. Jones' instructive illustrations and remarks.

The evening session was followed by a special meeting of the members to discuss matters pertaining to the welfare and advancement of the Society.

The morning session, Thursday (the 19th) was given over to three papers, viz., the LIGHTING OF THE BUFFALO GENERAL ELECTRIC COMPANY'S BUILDING, at Buffalo, N. Y., by Mr. W. D'A. Ryan; the THEORY AND CONCLUSION OF ILLUMINATING CURVES, by Mr. Frank A. Benford, Jr., and CHARACTERISTICS AND TESTS OF CARBONS FOR ENCLOSED FLAME ARC LAMPS, by Messrs. Allen T. Baldwin and R. B. Chillas, Jr.

In the afternoon a trip to Buffalo was planned as the guests of the Buffalo General Electric Company, embracing a luncheon and inspection tour of the Company's handsome new office building, now under course of construction, the lighting of which was reviewed in Mr. Ryan's paper.

International Acetylene Association

The annual convention of the International Acetylene Association was held in Chicago for three days beginning July 23 last, and was marked by much earnest-

ness of all participants.

Something should be said about the intense signs of life, vigor and earnestness present throughout the Chicago meetings. It is but the truth to say that this was never more apparent in any of the Association's annual conventions. Every one appeared wide awake, and there was never any lack of speakers ready to share in the interest of brief talks.

For President Collins it may be said that he proved to be an excellent presiding officer, not letting the proceedings drag for a single instant.

Acting on past favorable experience this year's meeting gave full attention to the social side of the affair. Since the time this feature was first adopted lady guests have increased in attendance, for they well knew that they would be thoughtfully provided for.

The newly elected president, Mr. P. A. Rose, while classing with the young men who have not taken a prominent part as Association members in the past, has, by his high business connections, shown himself to be most promising material for the presidential office. It surely was a

case in which the office sought the man.

In the matter of vice-president, the Association was equally fortunate. Mr. Charles E. Ummach, of Chicago, the unanimous choice, is well known in the acetylene industry.

Mr. A. Cressy Morrison's re-election as secretary and treasurer was a foregone conclusion. No other person had been thought of or suggested for the place, and the spontaneous way in which the convention arose as one man to declare his election by a standing vote showed exactly the appreciation in which he is held.

The three directors chosen, Messrs. A. C. Collins, M. Kirchberger and A. D. Meeker are well known in the acetylene

industry.

FUTURE

National Commercial Gas Association

The Eighth Annual Convention and Exhibition of gas appliances of the Association will be held in the Auditorium-Armory, Gilmer and Courtland Streets, Atlanta, Ga., December 2 to 7, 1912.

The opening and all subsequent business sessions of the Convention will be held in Convention Hall, located in the Auditorium-Armory, beginning Tuesday morning at 10 a.m.

After the usual business incident to the opening of the Convention, including the address of welcome, reports of the Board of Directors, President, Treasurer, Secretary and committees, election of new officers, etc., papers to be presented will be as follows:

Tuesday Afternoon.

Commercialism of Gas Lighting Industry,

by R. F. Pierce.

Wednesday Morning.

Gas Industry from the Consumer's Standpoint,

by Hon. Leslie M. Shaw.

Thursday Morning.

Organization and Administration of New Business Departments,

and Methods for Development of

by M. Webb Offutt, Industrial Fuel as a Revenue Producer

Large Consumers, by John S. Welch.

Friday Morning.

Gratuitous Work for Consumers, the Reasons, Precautions and Its Remedies,

by E. C. Weisgerber.

Sales Campaigns,

by James P. Hanlan.

There will be open discussion on any subject pertinent to commercial gas business, either from the standpoint of the gas man or the gas appliance manufacturer. Advance hotel reservations indicate unusual interest and large attendance.

National Electric Light Association

New England Section

The Fourth Annual Convention of the New England Section of the National Electric Light Association will be held in Mechanics Building, Boston, Mass., October 15, 16 and 17, 1912. This convention is to be held during the 1912 Boston Electric Show and in the same building, and it is planned to invite the entire membership of the National Electric

Light Association. This will give those who could not attend the convention in Seattle last June a fine opportunity to attend a big convention this year and at the same time visit the Electric Show. There will be seven interesting papers presented and discussed, besides many other features of interest now being planned for the visiting delegates.

EXHIBITIONS

New York Electrical Exposition

The New York Electrical Exposition of this year, to be held at the New Grand Central Palace from October 9 to 19, will surpass any held in previous

years.

One of the most interesting exhibits will be one furnished by the United States Government. This will include an exhibit of the Army Department, which will show field communication, model of fortress and magazines. An exhibit by the Coast Defense Department showing sub-marines with aeroplane connections. The first words sent under the jurisdiction of the army in connection with the Panama Canal will be sent by Mr. Thomas A. Edison from the Palace to the headquarters at the Panama Canal. The Navy Department will exhibit a model wireless station, show searchlights, how ships are wired for electricity, and will also have three model ships of the latest design. In this exhibit there will also be many relics taken from the wreck of the Maine.

The Bureau of Standards, Bureau of Census, Bureau of Mines, and also the Isthmian Canal Commission will have in-

teresting exhibits.

New York State will have an exhibit from the Horticulture Department showing how electricity aids in the growing of flowers by static charges. The Bureau of Mines will also exhibit their Pulmotor, which is used as a resuscitating motor, practically bringing back to life persons drowned or knocked out by electric shocks. The Irrigation Department of New York State will show a transmission line and the Department of Agriculture will exhibit a nutrition experimental station.

On the third floor of the Palace will be an automobile track for electric vehicles, where will be shown all types of cars in operation. The American Museum of Safety will cover about 5000 square feet of floor area, and exhibit 40 cases of appliances brought over to this country by Dr. Tollman, Director of this Society. There will be a chicken farm, showing how chicks, hens and Guinea hens are raised by the aid of electricity.

An electrical derrick used for excavating will be in actual operation, showing how the bucket actually digs and conveys

dirt.

As in previous years, there will be an electrical tea room larger than ever, and an electric laundry. Different exhibits of cigarette making will be shown, as well as how chocolate is made, taking it from the bean and going through the stages as the sweets are made.

One of the most interesting exhibits will be a large switch-board as used at the Waterside Station of the New York Edison Company. This board, after the exposition, will be used by the New York Edison Company in their station.

The lighting of the exhibition will be one of the most interesting features, as attempt will be made to demonstrate all the most modern methods of lighting, and it is hoped that it will be well accomplished, because of the fact that the building itself is so designed that it can be applied for the utilization of any system. A very interesting exhibit will be that loaned by the Electrical Testing Laboratories to the Bureau of Illuminating Engineering of the New York Edison Company, which will show all modern glassware used in lighting, both for utilitarian purposes and for artistic. In connection with this there will be shown old types of shades, reflectors and other glassware, as used in former years. This exhibition was collected after

considerable time spent by the Electrical Testing Laboratories of New York, and was recently shown at the Association of Edison Illuminating Companies at Virginia Hot Springs.

The exhibition will last for ten days, it being the object of the directors to pre-

sent to the public all modern uses of electricity as is available at the present time, and there are at present a number of applications for spaces in the show that cannot be accommodated, and it promises to be the most dignified, interesting and successful show of its kind ever held.

Boston Electric Show

The Boston Electric will be one of the most elaborate and comprehensive Electrified Trades Expositions ever held.

Much time and money have been expended in the development of this show. The management has been working steadily for two years, and the investment, when the doors open, in preparatory development and publicity will approach \$200,000.

The show will continue for a month, September 28 to October 26, inclusive.

A great number of people will visit this show. The co-operation of three hundred New England central stations, reaching the nearly ten millions of people in that section, will bring, by means of excursion trains and special rates, thousands of people to see this big trades exhibit.

The show is under the management of Mr. Herbert W. Moses.

The Advertising Department has been in charge of Mr. L. D. Gibbs.

The real mainspring and inspiring genius of the show, however, has been and is Mr. W. H. Atkins, General Superintendent of the Boston Edison Company.

Two years ago an organization was perfected to bring out in 1912 the "Biggest Electric Show That Ever Happened." That organization has been busy ever since, and will be very much so until the closing night of the show, October 26. The dates seemed long ahead, but, as one after another the large phases of the project were brought out, analyzed and their solution undertaken, it was realized that the time was all too short.

First came the leasing of Mechanics' Building, which, although built a score and a half of years ago, is still counted the largest permanent exposition structure of the kind in the country.

The time for the show was picked because October has been for years long gone the show and convention month in Boston; the time when all New England takes "a day off" to visit its capital city. It was the time for the old Mechanics' Fairs that attracted thousands and thousands of people year after year until 1898. Nothing approaching those fairs in quality and inclusiveness of exhibits has been seen in New England since that time until now comes the "Electrified Mechanics' Fair!"

Thus the time and the place are psychologically opportune.

One aim has been to collect in this show representations of every practical and economical, as well as many as possible of the novel applications of electric service.

Meantime the working out of plans for street illumination and interior decoration and lighting of Mechanics' Building was going on. Plan after plan was submitted, the best points selected from them, and artists and decorators sent back to work out new ideas or bring forth fresh designs through the harmonizing of the best of several others. A year ago the building decorations were decided upon, the contract let, and the work begun. Everything was built according to scale, so that, as soon as Mechanics' Building was available for the setting up of the exposition, the pieces, like a jig-saw puzzle, went together in quick time.

During the first quarter of the year preceding the show, one hundred men were at work every day building the decorative pieces. From then up to two months before the show, one hundred and fifty men were busy. During the last two months preceding the opening of the show

several hundred men were at work during all the daytime, and for the last two weeks, day and night. Everything went together with the precision of the setting up of a big machine. The supply mains for delivering current to the various exhibits were put in; then the decorations were fitted and set up; and then the supplementary wiring for the exhibitors taken care of.

Meanwhile, details were perfected on the plans for the street illumination. Never before has anything so elaborate been attempted under similar circumstances. For a mile, from Copley Square to. Massachusetts Avenue, Huntington Avenue will be a blaze of light. Special decorative lighting effects have been produced. Down both sides of the avenue will be forty-four poles; two poles at either end of the stretch will each carry thirteen special flame arc lamps, each of enormous candle power; the remaining forty poles will each have four big arcs. Remarkable color lighting effects will be secured from these lamps by the use of special carbons made for the first time for use at this show.

The outside of Mechanics' Building will be outlined and illuminated with 30,-000 incandescent lamps of different colors and special designs in beautiful Mosaic effects. Never have so many lamps been put on the exterior of any building in New England, and only has this number been exceeded in the case of some of the biggest buildings at world's expositions.

It is difficult to even attempt a description of the interior decorations. Entrancingly beautiful effects have been secured by the use of fireproofed, decorative materials, and by the lavish application of the brushes and paints of talented and highpriced artists. Not a single square foot of the ordinarily barren and uninviting interior of Mechanics' Building will be visible. The whole scheme is classic and simple in design, yet wonderfully beautiful. Grand Hall is typical of a substantial German village, the effect being borne out by the gallery construction and designs of

the decorations for the exhibit booths on the main floor. The Electric Vehicle Section bears out the illusion of an open park. with its boulevards, trees, and beautiful park lighting effects. Here are shown the highways where the heavy traffic is carried on by means of electric trucks, and the winding arbor ways, drives and parkways where the electric pleasure vehicles glide in their silent, efficient courses. Machinery Hall bears out the illusion of a large factory, with its brick walls, open windows and ample illumination, characteristic of the electrically equipped manufacturing establishment. The galleries and broad halls of the second floor conform in their decorations to the character of the exhibits; the same is true of the large spaces in the basement.

The three hundred central stations of New England are co-operating in carrying out this show, because of the educational effect it is certain to have upon the people in the territories they serve, and because the benefits from this educational influence must accrue directly to the electric lighting business. Along with these central stations in hearty co-operation are the manufacturers, supply dealers, and This co-operation wiring contractors. does not mean in any case an opportunity to share in making up any deficit at the end of the show or a promise of a share in possible profits at its completion. There will be no deficit; there will be no profits for anybody to share or divide.

The Edison Electric Illuminating Company of Boston undertook this exhibition with two objects in view: First. A tremendously important and effective educational campaign in the interests of electric service to extend throughout New England, and, indeed, throughout the whole country. Second. To show the people (and to develop in proportion their good-will) that here is a public service corporation with enough enterprise and resource and public interest to prompt it to develop another "Biggest Enterprise" for Boston and New England. And the show

will be a success.

PROGRESS

Improvement in Lamp Packing

Decided changes in standard practise as regards the style of carton used for packing tungsten lamps have just been put into effect by certain prominent incandescent lamp manufacturing interests of the United States. The new style of packing, which is described in detail below, calls to mind the fact that there has been steady progress in the methods of preparing incandescent lamps for shipment since they became a commercial product. Originally lamps were wrapped in tissue paper, packed in hay or straw, and shipped in ordinary barrels; breakage was high, the packing process was slow and difficult. errors in counting the number of lamps in the shipments were not uncommon, and the arrangement was generally unsatisfactory. The barrel method of packing was practically abandoned in favor of the standard package box or case method about seven or eight years ago, and lamps were now placed in unfaced corrugated strawboard sleeves and symmetrically packed in specially constructed wooden boxes. With the advent of the metal filament lamp, which at first was exceedingly fragile, the style of wrapper used on individual lamps had to be changed. Folding pasteboard cartons were introduced and each carton as prepared for shipment contained not only the lamp, but also a generous supply of cotton wadding around the latter in order that mechanical jars might be absorbed thereby. With this method of packing, which also included the provision of excelsior between the pasteboard cartons and the containing wooden standard package box, and plenty of cautioning labels on the outside of the package, breakage in transit was reduced to less than I per cent. before the introduction of the drawn wire type of lamp. With the advent of the latter type, last

year, it was soon discovered that the certons could be materially simplified and improved along a number of different lines.

As a result of careful investigation, thorough examination of literally hundreds of different samples of cartons, tests on the most promising samples by competent engineers, and mature deliberation by the lamp manufacturers, who have also consulted with many of the large agents of their product, tungsten lamps are now being packed in "unit" cartons, each containing five lamps. Since the number of lamps in a standard package is almost always some multiple of five (e.g., 50, 100, etc.), lamps can be shipped in the same quantities as hitherto, but will be contained in the new five-lamp cartons instead of in single cartons as formerly. Furthermore, a strong double-faced jute and jute-corrugated package has been substituted for the wooden box as an outer container, with a reduction of from 14 to 18 per cent. in the gross weight of package and lamps. The combined effect of the new cartons and the new outer boxes has been to reduce the gross weight of package and lamps by about 40 per

Regular multiple lamps in the ordinary commercial voltages and in wattages from 15 to 60, inclusive (both pear-shaped and round bulb types, with the single exception of the 60-watt round), are being put up in the five-lamp cartons. The carton for five 15-watt lamps measures 9½ x 2½ x 4½ in.—about the size and shape of a large brick or tile—while the five-lamp 60-watt carton measures 12½ x 3½ x 7½ in. The five lamps are placed side by side in the cartons, alternately "tip up" and "base up," each lamp being surrounded by a corrugated wrapper or

sleeve similar to those in which carbon filament lamps have been packed. Wad-

ding is eliminated.

As put out by the various works of this company, the five-lamp carton bears on one of its large faces an ornamental design in two colors, illustrating the lamp. On the top flap of the carton is the patent notice and on one of the ends appears the name, monogram or characteristic emblem of the particular brand of lamps contained. This end also carries a label identical with the type label on the lamps themselves, giving the rating in watt and volts. The flaps of the carton are sealed in order that the consumer may have evidence that the lamps have not been changed or tampered with since leaving the factory. This, of course, is a protection to the agent or central station handling the lamps as well and does not prevent the latter from opening a carton in sight of the ultimate consumer, if desired, in order to demonstrate that the lamps distributed are intact.

Possibly the greatest benefit of the new method of shipment is the convenience afforded to agents in the handling of cartons from the time they are removed from the corrugated package in which they are received until they are placed upon the retail shelves. It frequently happened that the small single cartons were dropped owing to the attempt to carry too many cartons at the same time in one's hands, or to a string giving way, etc., with disastrous results to the lamp in some cases. With the five-lamp cartons the danger of dropping is much decreased, and inasmuch as lamp breakage now consists mostly in breakage after the package is unpacked and not in breakage during shipment, this means in effect that breakage is now practically eliminated.

Such severe tests as the rolling of full packages of lamps down a long iron staircase have been conducted and indicate that lamps packed in the new way should pass safely through all the rough handling that the outer corrugated package will stand without breaking apart. This, of course, is not inconsistent with the statement that packages of incandescent lamps should always be handled with extreme care by the agent. The space economy of

the new carton is great; for exa te, five 25-watt lamps in one of these car will occupy only 27 sq. in. on the dealer's shelves, while five of the old 25-watt cartons occupied at least 45 sq. in., a saving of 40 per cent. in shelf room. In addition, owing to the provision for wadding, the old 25-watt carton stood 1/4 in. higher than the new.

The change, it is believed, is one that will appeal particularly to the trade, for it was largely due to the insistent demand of agents handling incandescent lamps for a multiple carton that this feature was introduced. The new scheme should not only increase retail sales and decrease breakage from the receiving room to the counter, as above indicated, but it does away with a good deal of the annoyance hitherto experienced in connection with disposing of the large amount of waste material used for packing. It also facilitates the taking of lamp inventories, since it is in general much easier to count up a hundred lamps by counting twenty of the five-lamp cartons than by counting a hundred of the single cartons.

From the consumer's point of view, the five-lamp cartons afford a safe and easy method of carrying several lamps from the electrical supply house to his premises. The tendency will be for the residential consumer to keep a carton of lamps on hand as a provision against burn-outs or other breakage of lamps in service, a tendency which manifestly benefits the central station as well as himself. other words, the number of empty sockets and sockets containing burned out lamp bulbs, which are left in merely to preserve the appearance of the lighting fixture in many residences, will be considerably decreased.

The thousand or so of salesmen who are specializing on incandescent lamps, either in direct connection with the lamp manufacturers or their agents, will also feel the benefits of the new style carton, since it will decrease complaints and dissatisfaction on the part of their customers, and also because it gives them—what every salesman is always looking for—a number of new strong talking points. The new method by which lamps are packed is in itself a demonstration of the

he of the of the of the phasizing of that usually invisit agh essential characteristic—high quarry in incandescent lamp manufacture.

Electrical Co-operation

The Electric Development Association has recently been organized and incorporated under the laws of Massachusetts, which has as its aim the furthering of cooperation among the electrical industry of New England.

Mr. Zenas W. Carter is the secretary of the association, with offices in Room 826, Exchange Building, Boston, Mass.

Mr. Robert F. Pack, Appointed General Manager at Minneapolis

Mr. Robert F. Pack, formerly general manager of the Toronto Electric Company, Toronto, Canada, has been appointed general manager of the Minneapolis General Electric Company. assumed office Tuesday, September 10. Since the resignation of Mr. A. W. Leonard, early in August, the position has been temporarily filled by Mr. Samuel Kahn, who will resume his duties in the operating department of H. M. Byllesby & Company, Gen. George H. Harries, vice-president of the Consumers Power Company, will continue to act in a supervisory capacity over all the properties of this corporation, Mr. Pack being in direct charge of the Minneapolis property.

Mr. Pack was born in England in 1874. He was educated for the British navy, but came with his parents to Canada at an early age. Twenty-one years ago he entered the service of the Toronto Electric Light Company as an office boy. At that time the lighting supplied in Toronto consisted of open series arc lamps. Mr. Pack advanced steadily through the positions of accountant,

comptroller, secretary and, finally, general manager of one of the largest of the Canadian electric companies, serving a population of about 450,000. He is ranked among the most progressive of utility managers. Mr. Pack is president of the Canadian Electrical Association and as such is also a member of the Executive Committee of the National Electric Light Association, and has also served upon various committees. He is also a member of the American Institute of Electrical Engineers and a member of the following clubs: Engineers' Club of New York, Engineers' Club of Toronto, Royal Canadian Yacht Club, Arts and Letters Club and Albany Club, all of Toronto. He was a member of the Publicity Committee of the Toronto Board of Trade.

Columbia Lamp Works

During the week of August 11 the sales organization of the Columbia Incandescent Lamp Works of the General Electric Company held its annual convention this year at Macatawa Hotel, Macatawa, Mich., a picturesque summer resort on the eastern shore of Lake Michigan. The programme of the week consisted of papers and discussions of commercial interest, all of which proved both interesting and helpful. The pleasant surroundings contributed to make the occasion an enjoyable outing.

Removal Notice

The Ornamental Lighting Pole Company have moved their headquarters to 116 Liberty Street, where they will be nearer the electrical center. This company, of which Harvey S. Tonks is general manager, furnished the poles for the now famous New Haven installation where the luminous arc is used. This installation has probably created more comment than any in the past few years, and is certainly a credit to all interested.

GCOD LIGI

And the Illuminating Ingineer

H.A.Buck Bus. Mgr. Robert R. Johnson Adv. Mgr.

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"BREADTH"

"Narrowness"—resulting from "riding a hobby to death"—"keeping one's nose too near the grindstone"—thereby losing one's sense of perspective, or the natural condition if one's knowledge is shallow, is of little consequence if retained within the confines of the individual.

If, however, the attempt is made, voluntarily or involuntarily, to shackle the public—progress—with such conceptions, then "narrowness" becomes close akin to a curse.

Breadth of ideals, of efforts, and accomplishments should be the guiding influence in a great movement or industry.

Light is a tremendously great and important subject.

Good Lighting is a magazine of "breadth "-a points.

Albert Jackson Marshall Edin of the



Courtesy Photographic Department The New York Edison Company

ILLUMINATION OF FACTORIES

SPECIAL REPORT BY DAWILSON

Introduction.

Illumination may be regarded from two points of view—"general" and "local." The term "local" is applied to the lighting of a small, circumscribed area, on which specific work is being carried on, and "general" to the lighting of the workshop as a whole. The two systems of lighting are, however, often not sharply

distinguishable.

A distinction must be also drawn between daylight and artificial illumination. Whereas artificial illumination is fairly constant, daylight varies from hour to hour and from day to day. These variations are not always evident to the eye, but they necessitate special methods of testing. Two rooms may appear to the eye to be lighted equally well by full daylight; but, when the light begins to fade, a difference in their qualities becomes more and more apparent. A further distinction is, that in artificial illumination we are able to control the position of the light-sources, whereas in the case of daylight this is not the case.

Daylight Illumination.—For the efficient daylight illumination of a given room: (1) The amount of daylight admitted should be as large as possible (2) the lighting should be as uniform as possible; (3) the light should fall on the work from the right direction. In order to satisfy (1) two conditions should be observed. (a) the window area, relatively to the floor, should be at least 1.10, and (b) the windows should be as free from obstruction (i.e., should command as large an extent of sky-area) as possible, in order to allow the admission of direct, as opposed to reflected, daylight. As will be seen later, the first condition (a) is particularly well observed in weaving sheds and similar buildings, in which the windows are commonly placed in the roof. In large rooms lighted by side-windows,

however, it is often impossible of fulfilment. The second condition (b) is also fully observed in rooms lighted from skylights, but is obviously difficult of attainment when side-windows are used and the factory is surrounded by adjacent build-

ings.

Other important matters are the variety of glass used (whether clear, frosted, or ribbed) and the absence of dirt and soot, the symmetrical placing of the windows, and the nature of the walls. Walls that are light in tint and have a matt surface greatly aid the diffusion of light. In a small room the illumination may sometimes be increased as much as five times by this means.

Assuming that the above points have received attention, it is also desirable that the light entering the room should reach the center or darkest point with as little obstruction as possible, and that dark shadows caused by local obstruction of the light should be avoided. The completeness with which this can be done depends on the shape and height of the machinery; in a room full of tall cotton-spinning machinery the obstruction is necessarily great. For side-lighted rooms the best position for machines is an arrangement in rows across the room, with the ends of the machines opposite to the wall-spaces between the windows. In this way the light is allowed full access to the gangways and the surface of the machines. Composing frames should be arranged in a similar way.

In rooms containing only small machines the arrangement is from this standpoint less important, but a sidelight is usually desirable for other reasons—e.g., distribution of shadow. For the avoidance of shadow light coming from the roof is the best, since the shadow is then formed immediately under the shadow.

work, where it is of no importance; in side-lit rooms the light should fall on the work from the side in such a way that no shadow from the operator's body is thrown on the work. A moving shadow is more troublesome than a stationary one. In general such shadows are most apt to be produced by artificial light.

Artificial Light.—In planning artificial lighting attention should be given to the following principles: (1) The light should be adequate having regard to the nature of the work carried on; (2) the light units should be arranged so as to cause no "glare" effects; (3) the light units should be arranged so as to produce

no troublesome shadows.

The intensity of illumination needed depends on the nature of the work, fineness and color of material, and other circumstances, and should vary according to the reflecting power of the material on which the work is being done. When materials of various tints are used, it is often desirable to have some means of varying the illumination by adjusting the distance away of the light-source.

Glare may be defined as the dazzling effect of a powerful light. The causes and effects have been fully discussed in *The Illuminating Engineer*, and Prof. L. Weber, of Kiel, has suggested a series of

rules.*

From this it would seem that the most important points to be taken into consideration are (1) the position of the light, and (2) its efficient shading. The light should be placed so that the angle between the direction of normal vision and the line from the light-source to the eye (termed "the angle of glare") should not exceed thirty degrees; or, if the light comes within this angle, it should be provided either with an opaque shade so arranged as to render the light source invisible, or with a diffusing shade reducing its intrinsic brilliancy to less than 2.5 c.-p. per square In most instances glare can be avoided by raising the lamps sufficiently, and it is desirable to keep powerful lamps high up. In shading lamps special care should be taken to ensure that its depth is sufficient to screen the lamp completely from the eyes. Shades are also of considerable service in concentrating the light on the work. For example, cases are mentioned in which the illumination from bare lamps on a surface 2 ft. 3 in. below them was increased respectively from 1.2 to 3.1 and from 25 to 7 foot-candles by the use of prismatic glass reflectors. The shade should also be selected with regard to the natural distribution of light from the illuminant with which it is to be used, so as to direct the light in desirable directions.

An effect sometimes spoken of as glare is produced by light directly reflected into the eyes of the operator from highly polished surfaces, such as are met with in engraving on copper. The remedy consists in careful selection of the position of the light source and effective shading, with a view to making the light as dffused as possible.

Reference has been made above to the question of shadow. The unit serving each area should be placed so that its light comes from the side—or, better—over the shoulder of the worker or from directly behind him. A common failing is for light to be so placed that the worker's own shadow is cast on the work; this causes much annoyance, as it is continually shifting with his movements, and can be avoided generally by better shading and raising the lamp. The fault is very common in composing-rooms, where the workers stand and the lights are comparatively low.

As regards the color of illuminants, the matter is relatively unimportant as far as work is concerned, for most industries, provided the illumination is adequate. There are, however, certain questions regarding the physiological effect of colors and of the ultra-violet and infra-red rays, but on these scientific opinion appears to be still divided.

METHOD OF DETERMINATION OF ILLU-MINATION.

The observations were made with a standard illumination photometer, furnished with certain accessories giving an increased range of 0.01 to 1,000 footcandles, and allowing the determination of "window-efficiency."

Generally speaking, measurements were

^{*} Illum. Fnc ii., 1910, p. 116.

made in a horizontal plane 3 to 4 ft. from the ground, but in special circumstances measurements were taken on vertical or inclined planes. For example, in the case of compositors' frames determinations took place on the slanting upper case of each frame. In local lighting measurements were made in the plane of the actual work.

The total number of measurements was 2,500. No attempt was made to secure very great accuracy, as it was thought advisable to collect data for as many rooms as possible, so as to obtain a general view of the conditions of lighting in each industry. Results are expressed in foot-candles. To give an idea of the strength of this illumination it may be mentioned that this is, roughly, the minimum value which enables small print to be read, that 0.1 footcandle is about the minimum illumination in a well-lighted street, and 0.01 the minimum value in a badly lighted street.

In measuring the daylight-efficiency of windows the method originally devised by Mr. A. P. Trotter, and more recently utilized by Mr. P. J. Waldram, in which the illumination in the room is expressed in thousandths of the unrestricted daylight illumination out of dors, was employed. It is pointed out that daylight measurements of this kind are necessarily very approximate.

INDUSTRIES UNDER INVESTIGATION.

The industries investigated included cotton weaving, linen weaving, cotton spinning and preparing, flax spinning and preparing, composing rooms in letterpress printing works, machine rooms in clothing factories, and machine rooms in hand-kerchief factories.

(a) Cotton Weaving.—Here the lighting is uniform and symmetrical, being compartively constant throughout the entire shed. The process is carried on almost exculsively in "sheds" or one-story buildings with "saw-back" roofs, the short sides of which are glazed. The incidence of lights is, therefore, vertical, and seeing that the work is in a horizontal plane, this is the best possible arrangement. Owing to the large expanse of window area, the "window-efficiency," as determined by the Trotter-Waldram

method, is very efficient; in the table given by Mr. Wilson values up to 44-1000ths are recorded, but the usual range is from 16 to 35-1000ths. Generally speaking, the rows of looms run across or at right angles to the direction of the windows, but in sheds in certain districts they run parallel. The former is by far the better arrangement, since the light coming sideways, throws no shadow on the work.

As regards artificial lighting, the object is again to produce a uniform illumination free from objectionable shadow. Lamps at a height of 6ft. 3in. to 7ft. are commonly employed. Inverted gas lights, and particularly high-pressure systems, are being already used, and the old flat-flamed burners are being gradually replaced. The absence of shadow beneath the inverted mantle is a distinct advantage.

When electric glow lamps are used, 16 c.-p. carbon filament lamps are generally used. Metallic filaments are rarely met with. There appears to be an impression that they are readily broken by vibration, but nevertheless they are common in the Irish weaving-sheds, where the vibration must be quite as great.

(B) LINEN WEAVING.

The weaving of linen is carried on in sheds exactly similar to those used for cotton weaving, and the conditions of daylight illumination are, therefore, substantially the same.

As regards artificial lighting, it is interesting to note that the reflecting power of linen is 30-40 per cent., whereas that of grey cotton is about 60-80 per cent. A more intense illumination is, therefore, generally found. Metallic filament lamps or high-pressure or low-pressure inverted gas lamps are usual, the allowance in general being one light per loom. This is fixed vertically above the stretch of cloth or immediately over the center of the "loom-top" or highest point of the loom. In the latter event glare is liable to occur, and several instances were noted in which weavers had purposely diverted the lamps in order to shield their eyes. In Appendix IV is shown a good example of lighting by means of deep shades, causing almost the whole of the light to fall upon the cloth. Sufficient light is diffused and reflected to illuminate the alleys isfactorily.

(C) COTTON-SPINNING.

Daylight.—Here we have an example of an illumination which is symmetrical, but more or less variable, as the light comes from side-windows, being mainly intended for the illumination of vertical planes. In modern mills the space between windows is made very small, so as to secure maximum glass area; but, nevertheless, the ratio of window-space to floor area is often 1.12 or 1.20. Here, again, the windows are usually arranged to come at either end of the alley between the frames.

The general characteristics of the light-

ing are:-

(1) The window-efficiency is high at each end of an alley, but diminishes towards the centre, where it is frequently only 1-100th to 1-500th of that at the ends,

(2) The general illumination of the room increases with the height above the ground as the windows become less obstructed by adjacent buildings and more

sky is visible.

(3) The window-efficiency at the center varies according to the nature of the machinery. roving rooms, containing frames with high creels, it is very low; next come ring-spinning rooms; the best lighted of all are the mule-rooms, with their broad alleys or "mule-gates" and

relatively low creels.

Artificial Lighting.—The most common method of lighting in spinning, and preparing-rooms is by carbon filament lamps placed at intervals along the alleys. In mule-spinning rooms each pair of mules is generally provided with two rows of lamps situated along the two sides of the " mule-gate." The lighting of these rooms is generally better than any other room in the spinning mill, while the preparing-rooms are often the worst lighted. The part of the room containing the cards is often very insufficiently lighted, and may be even dangerous from the point of view of liability to accident. An illumination intensity below 1-100th of a footcandle was sometimes recorded.

(D) FLAX-SPINNING.

Dayli illumination is carried on under tions very similar to cotton-

spinning, but the rooms are narrower, the frames are set wider apart, and the ratio of window to floor area is, therefore, better.

Artificial lighting is mainly by metallic filament lamps suspended from the ceiling to within 3 ft. from the floor. The object is to illuminate the under side of the drawing rollers, a specially important point when breakage occurs. Lamps are protected by an outer covering of thick glass and iron bars.

(E) Composing-Rooms in Letterpress Printing Works.

Daylight Illumination.—A specially good light is needed on account of the dark material and trying nature of the work. As a rule composing rooms in towns are badly lighted, except when situated on the top floor, where skylights can be provided. However, composing rooms in many newspaper works are very little

used during the day.

Artificial Lighting.—The fine nature of work and dark material demand a strong illumination. The reflecting power of the material appears to be only about 5-10 per cent. The usual method of illuminating the frames is by lamps a few inches above the upper case. In a few rooms inverted arcs are in use, and mercury vapor lamps have also been used. Unfortunately, glare is not always avoided, although it is very essential that this should be so. Several examples of good and bad lighting are given in the Appendix.

(F) Sewing Machine Rooms in Clothing Factories.

Daylight Illumination.—Here, again, the work needs specially good light, but the obstruction due to machinery is much less than in other industries.

Artificial Lighting.—The artificial lighting is very efficient as far as intensity is concerned, but glare is often noticeable owing to the lamps being unshaded and too low. Two systems of lighting deserve notice. One of them involves the use of adjustable bracket stands carrying 8 or 16 c.-p. lamps protected with opaque metallic shades. Another system, which is sketched in the Appendix, utilizes small 4-volt glow lamps attached to the frame and provided with an appropriate screen shade

concentrating the light on the needle. Special care is necessary to avoid troublesome shadows in this work.

(G) SEWING MACHINE ROOMS IN SEW-ING HANDKERCHIEF FACTORIES.

Illumination. — Whenever Daylight possible machine-rooms are placed on the top story, so as to be lighted efficiently by skylights. In some factories the machines have been transferred to specially constructed one-story buildings for this purpose.

Artificial Lighting.—The artificial lighting is invariably good, the usual practise being to place the lamps at intervals down the centre of the table. In each romo there is one table set apart for specially fine work known as "shiring," where the allowance of lamps is doubled. The lamps are generally well shaded, and glare is unusual.

Conclusions.

As was previously stated, for the perfect local lighting of work, the three following conditions should be complied with: (1) The illumination must be adequate; (2) "glare" effects must be absent; and (3) no troublesome shadows must be cast on the work.

Adequacy.—In deciding on this point attention must be given to the class of work carried out, for a standard which would be quite sufficient for one class of work may be totally insufficient in another.

For this purpose work may be divided into two classes-"inspective" and "detective," according as the work entails continuous application of the eve to one small point of area, or consists merely in keeping a general watch over a given process, actual labor being demanded only when some fault occurs. Of the industries considered, the making-up of clothing and handkerchiefs and composing belong to the first class, and the second class comprises cotton and flax spinning and pre-Weaving appears to be intermediate between the two classes.

As regards intensity of illumination, these classes are strongly distinguished, but the illumination also appears to depend on the fineness and color of the material. In "inspective" work the eye is continuously applied to a small area, and it is specially important that there should be both adequate illumination and absence of glare. The following table gives a rough estimate of the illumination intensities provided for different classes of "inspective" work (artificial light):

	Reflecting	
	power of Il	
	material (in	intensity
Industry.	per cent.). (f	tcandles).
Clothing (machine room	s) 1—13	2-36
Handkerchiefs (machine		
rooms)	60—97	28
Composing rooms	5—13	330
Cotton weaving	60—80	15
Linen weaving		3—18

It is difficult to state the minimum absolute illumination intensity necessary by Cohn has recommended 2:5 foot-candles for schools, and it was noticed that on several occasions an illumination of 1:5 foot-candles was regarded as inadequate.

For "detective" work the standard of illumination is much lower, and comes under the heading of general rather than local lighting. The area served is much more extensive, and the range from minimum to maximum illumination correspondingly great.

The following are the illuminations met with in factories for "detective" work:-

Industry and room.	Illumination, ftcandles.
Cotton spinning:	it. canaics.
Preparing rooms—	
At cards	$\dots 0.01 \text{ to } 0.7$
At combing frames	0.1 to 2.0
At drawing frames	
At roving frames	0.02 to 1.3
Ring spinning rooms	
Mule spinning rooms	
Flaxing spinning:	
Preparing rooms	0.2 to 1.0
Wet spinning rooms	
Reeling rooms	

Glare.—In this respect the artificial lighting is often far from satisfactory, which is the more remarkable because the defect could usually be remedied without any difficulty.

For example, at a clothing factory the lamps were arranged in the customary manner in a row along the center of the table facing the workers, the machines being arranged along either side. needles were about 2 ft. 3 in. from the point vertically under the lamp, and the lamps were about I ft, above the table. The angle of incidence was, therefore, 66 deg., and the "angle of glare" was about 43 deg. When the lamps were: 1 ft.,

not only had the angle of glare increased to 60 deg., but, owing to the much smaller angle of incidence (48½ deg.), the illumination at the desired point was actually more than before.

Glare is often pronounced in composing-rooms. In these the surface illuminated is usually vertically under the lamps, and these, therefore, cannot be raised without some loss of light; but, by making use of an efficient reflector, there should usually be no difficulty in setting the lamps at a height sufficient to obviate discomfort. A still better method is to use a suitable deep opaque shade (see drawings in Appendix). Where very intense illumination is not needed, the best position for the units is undoubtedly high up behind and a little to the side of the worker. By this means both glare and inconvenient shadows can readily be avoided.

Shadows. — Shadows are sometimes troublesome in machine-rooms, especially where a whole group of machines is illuminated by a single powerful unit placed in the center. Sometimes— e.g., in composing-rooms—a troublesome shadow is cast by a neighboring unit intended for an adjacent spot. Shifting shadows are particularly inconvenient.

Shadow-troubles are not usually met with in "detective" industries, where the illumination is less and the contrasts not so marked.

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APPENDICES I-IV.

To these appendices we can only refer briefly, but the tabular data presented will doubtless be very useful for future reference. Appendix I. is devoted to a summary of the analysis of the premises visited for these measurements, comprising 160 rooms and 61 factories. The majority of these factories were cotton-weaving establishments.

Appendix II. and III. contain explanatory notes of the tables of daylight and artificial light which follow. In Appendix II. a series of eight tables, corresponding with the divisions A to G in the text, are assembled. They occupy eleven pages and are most exhaustive, full particulars of the area of rooms, window-space, illumination, and "window-efficiency" being given. On these tables the conclusions given previously are based.

Appendix III. (six pages) contains a similar series of tables giving particulars

of the artificial lighting.

In Appendix IV. there are some sketches showing the good and bad systems of illumination.

In conclusion, it may be suggested that this report will be beneficial in showing how feasible measurements of illumination have become, and there is no doubt that they will do much to systematize factory lighting in the future.

(Note.—In dealing with this report we have been obliged to abbreviate many portions, and those desiring fuller details are referred to the official version; special interest attaches to the complete series of measurements of illumination tabulated in the Appendix.)



The Lighting of the New Lawyer's Club

By George Teland Sunter

Extremely interesting is the lighting of the new Lawyers' Club, which was planned by Henry J. Davison, the decorator employed by the United States Realty Company to plan and build the Club. Like the Whitehall Club the Lawyers' Club is situated at the top of a skyscraper,

added above for the service quarters. In the main lounge, the lighting is indirect, the lights being concealed near the top of the large wooden columns and in the bowl of the wooden standards. As the ceiling is light in color and not particularly high, the illumination by re-



FIG. I .- DINING ROOM,

in this case the United States Realty Building at 115 Broadway. A little over four months ago the twentieth and twenty-first floors of this building were still occupied by commercial tenants. Since then, at an expense of \$250,000, the twenty-first floor has been cut through to allow sufficient height in the diningroom, and an additional floor has been

flection from above is effective, and much less wasteful than is the case with the majority of indirect-lighting installations. What is most important of all in a club which is used in the day time only, the artificial light can be and is used to supplement daylight without any sense of confusion or mixture. As everybody knows the mixture of daylight with artificial



Planned by Henry J. Davison. Designed by J. Gordon Guthrie. Made by Kimberly Company.

FIG. 2.—THE WINDOW.

light distributed from exposed sources, is not only inartistic but annoying to the eye.

The huge lanterns that hang from the ceiling in the main dining-room are of pleasing form and the panes of isinglass

soften the lights and hide the bulbs agreeably.

The illumination feature, however, of the whole Club is the magnificent stained-glass window that is the decorative key-note of the main dining-room.



FIG. 3.—THE LOUNGE.



FIG. 4.—THE FIREPLACE.

In the Gothic style of the Fifteenth Century it pictures, in fourteen separate panels with tracery work above, the story of the Law—the origins of Roman Law and of English Law and the merging of both in American Law.

But to return to the feature of the window that especially interests lighting experts. The back of it is *not* exposed to the open sky, to receive the reds of the morning sun and the various tones that finally culminate in the white light of noonday. The back of the window looks squarely into a solid wall, against which

decorators less skillful and less courageous than Mr. Davison would have hesitated to put a stained-glass window. But Mr. Davison knew the problem of artificially lighting stained-glass windows.

This window is lighted evenly by indirect means, and with the degree of brilliancy that gives it the best appearance, by light evenly distributed from reflecting mirrors. It is perfectly lighted by night as well as by day, and will be a great attraction when the Club is opened for special banquets or meetings in the evening.

The White Way and the chickens

We have evidenced much development in the creation of brightly lighted lanes for the use of humans. It probably, therefore, was but natural that such conditions would be extended for the pleasure of other inhabitants on this sphere.

We have recently read of a noted French beauty who, in her efforts to dispel ennui, procured a farm and proceeded to introduce the cows, pigs, chickens, and other occupants to the pleasure indulged in by the gay Parisians. These fortunate (?) animals, et al, were the recipients of cocktails before breakfast, frappéd champagne by evening, and other equally intoxicating beverages in between times. The effects of such treatment were varied and unnatural, to say the least.

We are now advised of the riotous living of chickens in Oklahoma made possible through the medium of a brilliantly lighted thoroughfare. It seems that every night the fowls, in a particular location in Oklahoma City, leave their premises and congregate under one of the big elec-

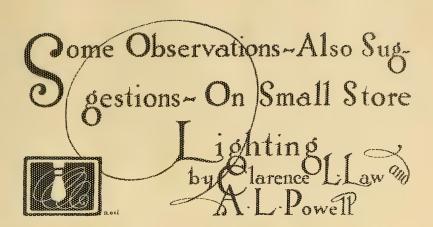
tric lights. Also drawn to the vicinity of the electric lamp are innumerable grasshoppers, the chickens feasting with considerable glee upon their less large but toothsome companions.

The attraction proves so alluring to the chickens that their owner experiences considerable difficulty in driving them back to roost. It is stated that sometimes the chickens remain up all night, going back to roost about daylight, the effect being that they are drowsy the following day and the hens do not lay.

The owner of the chickens blames a dissipated old rooster for the demoralization of his flock. He says the rooster was out late one night and discovered the grasshoppers. He gallantly called the hens and they left the roost to answer. Since then the hens have waited each night for the light to be turned on and the feast it brings to them.

Our feathered friends seem to appreciate a good thing.

They'll now go the pace!



The primary purpose of this paper is to give the results of a recent investigation of the lighting of small stores carried on under our direction. The object in making observations and collecting data was to learn as much as possible regarding methods employed and results obtained in the lighting of small stores, which information, first, would serve as an approximating guide in further work of a similar character, and secondly, evidently show the faults to be avoided—and practical, realistic ideals to establish.

Observations, data, and suggestions berewith referred to involve only that form of lighting that may be styled as direct. Semi-indirect and indirect are not considered in this article. These important forms of lighting will be treated with in later articles.

Over eight hundred small stores were visited in New York City, Newark, and the adjoining cities in order that the installations investigated should represent average conditions throughout the country. Only stores on the less prominent avenues and cross streets were visited. Fifth Avenue, Broadway, Fourteenth St., Twenty-third Street, Forty-second Street, and One Hundred and Twenty-fifth Street, New York; Broad and Market Streets, Newark, and like streets were carefully avoided as not generally typical of the small stores under investigation.

The shops along Fifth Avenue and the like, although sometimes small in dimen-

sions, cater to such an exclusive class that great individuality of treatment is most essential in their lighting equipment. The stores along some of the other avenues mentioned may include light for advertising value, and hence are not typical of our classification. Corner stores were not included, as it was apparent that their standards were invariably higher than the stores located on the block, due to the tendency toward display lighting. And here we encounter a peculiar condition. Assume the corner store is naturally more advantageously located than those in between. Then, those between, with lower rent to pay, by the not extravagant and judicious use of current may be caused to more nearly rival corner locations. The poorer the location, the more need of light to make premises attractive; a simple fact that merits general recognition and development.

At each store investigated the following facts were noted and carefully tabulated: Address; type and nationality of the proprietor; dimensions of the store; number of lamps; class, (clear or bowl frosted); reflector equipment; arrangement of lamps, watts per square foot; color of ceiling, color of walls; height of ceiling; height of lamps, show window; number of lamps; arrangement; wattage; class, etc., reflector and general remarks.

All these data were taken in order to afford a means of ferreting out errors and

discrepancies.



FIG. I.—LIGHTING TYPICAL OF ART STORES IN THE SMALL-STORE CLASS



FIG. 2.—LIGHTING TYPICAL OF BAKERIES IN THE SMALL-STORE CLASS $$386\$

For the purpose of simplifying the issue of our investigations, the results were obtained in watts per square foot on account of the similarity of the units and because their value serves roughly as an indication of the cost, and with reasonably close approximation the quantity of light. These values could not be applied to arc lamps, or other electric illuminants. They are based on the use of tungsten filament electric incandescent lamps and ordinary glass reflectors.

zontal plane. The recommended values in the paper given, therefore, are based on the assumption that a reflector of relatively high efficiency will be used, and, of course, should be modified if some partly decorated shade is adopted, or if indirect or semi-indirect lighting systems are installed.

Figures of typical installations of each of the main classes were taken in the stores lighted at night, and are given here to supplement the text.



FIG. 3.-LIGHTING TYPICAL OF BARBER SHOPS IN THE SMALL-STORE CLASS

One fact which was apparent in almost all investigated stores is that the show window lighting helps to build up the lighting in the fore part of the store interior. There is usually no dividing partition between the store and the window, hence the values given for watts per square foot, which take into account only the units in the store proper, would be low if the windows were separated from the store by an opaque wall.

The wattage required for any desired intensity in store lighting will naturally be higher if the illumination is necessary on the side walls rather than on a horiThe brief discussion given below applies to store lighting in general, and although this topic has been discussed before, we believe it will bear repetition.

The matter of store lighting is of primary importance. The successful store-keeper must be up-to-date and progressive in all phases of his business. In this age of competition, particularly in the retail lines, to be ultimately successful the shop-keeper must carefully scrutinize every detail of his store layout and business methods, i.e., his store must be arranged to attract the public, then, when he has their trade he must keep ig. There must

be nothing which will tend to displease customers, and cause them to go elsewhere. Just as his clerks must be courteous in order to retain the patronage of the public, so must his lighting be arranged with the same object in view.

Moreover, the lighting system should be in part considered as an advertising medium—having power to draw people in to inspect. The general effect should be such as to show off the goods to the effects are possible with but slight increase in cost, insuring valuable returns.

The system must also be such that the cost to produce the desired effect is at a minimum, thus keeping down the eternal bugbear—overhead charges. The small store proprietor is usually limited as to the amount of money he can spend for lighting, and hence is likely to consider only efficient illuminants and accessories, even though the general effect produced



FIG. 4.—LIGHTING TYPICAL OF CIGAR STORES IN THE SMALL-STORE CLASS

best advantage, assuring larger and more profitable sales.

Not only must there be the correct quality and quantity of light to insure an advantageous presentation of goods, but there must be no discomfort arising from the lighting system, such as eye fatigue, which may cause the customer to go where he or she can shop in comfort.

The lighting system should wherever and whenever possible be in keeping with surroundings—different from competitor's installations by employing other than monotonous, commonplace equipment, devoid of pleasing personality and effective advertising value. Consistent is entirely out of keeping with his establishment. He is likely to overlook or underestimate the value of the psychological and artistic sides of good lighting.

The light-sources and accessories should be efficient, permitting of an economical maintenance, yet these factors should be employed to get lighting effects consistent with requirements. This development is not always easily possessed in small store lighting, such as were investigated, but the standard can be advanced with intelligent effort to the advantage of all concerned. The results obtainable are well worth any effort that might be expended.



FIG. 5.—LIGHTING TYPICAL OF CLOTHING STORES IN THE SMALL-STORE CLASS



6.—LIGHTING TYPICAL OF CONFECTIONERY STORES IN THE SMALL-STORE CLASS

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INTENSITY.

It is a well known fact that there is a certain range of desirable intensity of illumination for the class of work in a factory; similarly, there are certain desirable ranges for goods on display at the various stores. It is often remarked that modern illumination brings out bad qualities in the goods; modern lighting here meaning improper light, for if the lighting is carefully designed the value of dis-

COLOR.

While in many stores the color of light is of importance, in the class of stores mentioned in this paper there is so little matching of goods that we may safely avoid a discussion of it. Of course, color of light is effective otherwise than in matching of goods. It plays a most important part in establishing pleasing and productive results, a condition which we do not always find in small store lighting,



FIG. 7.—LIGHTING TYPICAL OF DELICATESSEN STORES IN THE SMALL-STORE CLASS

play goods will be enhanced instead of depreciated. For instance, the authors encountered in the poorer section of New York, a second-hand furniture dealer who was rabid in his fancied objection to the tungsten lamp-it showed too readily the imperfections in his goods. The chief difficulty was that the merchant had too high an intensity of illumination. On using a smaller sized lighting unit he obtained satisfaction. Of course, in the average store the intensity should be such that it brings out the good qualities perfectly. It is obvious that a black gas range will require different intensity of light than a piece of white dress goods.

but one which we can to the credit and value of all concerned work to.

DISTRIBUTION.

Light distribution is one of the essential factors to be considered in designing a lighting installation for a store. Deep shadows should be avoided, and all places where the goods are on display should have an equal share of the total flux of light. We can approximately accomplish this by the proper location of pre-determined lighting equipment.

Variation of illumination intensities is something usually noted in average conditions—uniformity rarely, if ever, being



FIG. 8.—LIGHTING TYPICAL OF DRUG STORES IN THE SMALL-STORE CLASS



FIG. 9.—LIGHTING TYPICAL OF DRY GOODS STORES IN THE SMALL-STORE CLASS

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obtained in practice. In some cases wide range in intensities of illumination is desirable, and in others the more nearly we come to theoretical uniformity the better. Requirements of different classes of installation determine required results.

CLASSES OF SMALL STORES.

Art Stores (Fig. 1). In a store like that shown in Fig. 1 the walls on which the pictures are hung form the planes of illumination. Preferably these should be rows of relatively small units 40—60 watt), located as shown in the picture, equipped with diffusing and reflecting media, giving a fairly wide distribution of light, are applicable.

If the store is very narrow and one of units is adequate, the lamps should be equipped with wide distributing and diffusing mediums. Glare should be especially avoided. When employing open glassware use—always—bowl frosted lamps. Better still, use enclosing glass-



FIG. 10.—LIGHTING TYPICAL OF FLORISTS' STORES IN THE SMALL-STORE CLASS

specially lighted to the desired intensity with a low value of general illumination. This, however, involves additional expense of installation and maintenance, and rarely finds application in the small store, though results obtainable warrant such equipment. Excellent results may be obtained by using metal or glass (if glass diffusing as well as redirecting) so constructed and placed as to direct most light to display (side wall). Light which is re-reflected or permitted to pass through the translucent glass reflectors would provide suitable general illumination.

If the store is of medium width two

ware of high diffusing nature. Such usage will help reduce objectionable polished effects from glazed fronts in pictures, and glossy effects (specular reflection) noted from oil paintings. The average watts per square foot found was I.O. We believe this value to be a trifle low to give good results; I.3 watts per square foot is recommended.

Bakeries. (Fig. 2). The counters and pie racks require the illumination. Although not in the particular instance shown (Fig. 2), a mirror is usually found in the rear of the wall counter, the reflection from which assists the general

lighting scheme. A single row of light units placed in the center of the store serves very well. These may be small and located on multi-arm fixtures, or larger on single stems. Glassware employed should insure a wide distribution of light. The average watts per foot was 0.82. As the ceilings and walls are usually light and clean, this is a good working value.

Barber Shops (Fig. 3). Inasmuch as the eye is the first organ or condition to consider in designing a lighting systemcated in front of the chairs, and this tends to neutralize the effect of the deep colored wall papers which are used to a great extent in the cheaper shop. One 60-watt bowl frosted tungsten lamp, equipped with an opalescent or frosted prismatic reflector giving a fairly wide distribution, hung about seven feet six inches (2.28 m.) from the floor, placed between each two chairs even with the top of the back will give an excellent light for hair-cutting, and for shaving. The maximum light



FIG. II.—LIGHTING TYPICAL OF HABERDASHERY STORES IN THE SMALL-STORE CLASS

and as the effect of light upon the eye when the customer is in the process of being shaved is of considerable importance—this feature of the lighting system of a barber shop merits first thought.

The heads—side and top—of the patrons in a barber shop furnish the planes of illumination. As the patrons are forced to lie back and gaze upon the ceiling, light diffused as much as possible is desirable. The row of chairs is usually placed about two feet from under a center row of lights, and there is considerable glare if a clear lamp and a clear prismatic reflector is used. A mirror is almost invariably lo-

will be on the end part of the patron's chin. There will be sufficient diffused light for general illumination. The average watts per square foot found (general illumination) was 1.23. This is about correct for an installation like that shown in Fig. 3, but the localized arrangement is preferred.

Cigar Stores (Fig. 4). Show cases or shelves occupy at least one wall. The paper or wall is usually dark, tending to increase the wattage necessary to properly illuminate the store. While the discernment of detail is not so very necessary, the dark color of the goods and their low to the color of the goods and their low to the store.



FIG. 12.—LIGHTING TYPICAL OF GROCERY STORES IN THE SMALL-STORE CLASS



F . 13. -LIGHTING TYPICAL OF JEWELRY STORES IN THE SMALL-STORE CLASS $$394\$

flecting power also add to the light required. The planes of illumination are the counters and show cases. Medium sized tungsten lamps with intensive opalescent or prismatic reflectors, giving a fairly wide distribution of light over the counters serve well. Enclosed glassware of a good diffusing type and of a character to add to the appearance of the store is desirable. The average watt per square foot was 1.45. This is a good working value, as

dark and require more than the usual amount of light. We recommend raising the value of the average watts per square foot found, 1.37, to 1.5.

Confectionery Stores (Fig. 6). These stores are usually as showy as possible and decorative fixtures predominate. Mirrors and shelves occupy nearly all the wall space. Quite frequently decorative wall brackets are placed alongside the mirrors. The shades (it is hardly possible to call



FIG. 14.—LIGHTING TYPICAL OF MEAT MARKETS IN THE SMALL-STORE CLASS

these stores are very small in size, and a pleasing appearance is essential.

Clothing Stores (Fig. 5). The walls of this type of store are usually lined with hanging suits or show cases; these, as well as the center portion of the store, must be lighted to permit inspection of the goods. Although the clear prismatic reflector is usually found in conjunction with the tungsten lamp the frosted prismatic or opalescent reflector is to be preferred on account of the greater diffusion or "softness" of the light. A row of large units singly, or small units grouped on fixtures, is suitable, with a local light for the mirror. The goods are to a large extent very

them reflectors) used in the average confectionery store are purely decorative. Clear lamps and a blaze of light seem to be desired. In lighting these places the ideas of the owner should be given due consideration; if a decorative system is demanded, the most efficient system that accomplishes this end should be used. Multi-arm fixtures with a number of small units are popular, and are usually equally spaced in a row between the two counters. A little investigation will indicate how desirable decorative effects may be obtained in an efficient manner, and without garishness-excessive and ill-unned embellishment.

Every effort should be made to help the merchant who desires to break away from the depressing monotonous commonplace. He appreciates, to a degree, the value of individuality as a productive medium, though he may not always know how best to obtain desired results. It is our place to assist him in his efforts. Good results may be obtained using about one watt per square foot; the average found was 0.97.

Delicatessen Stores (Fig. 7). The stores of this class are usually very nar-

The average watts per square foot found was 1.1 This value would give a cheerful and well lighted store.

Drug Stores (Fig. 8). Here the walls are lined with shelves holding bottles and packages. The labels must be read easily. The tables and counters must also have a fair amount of illumination. The stores are of medium width and are best lighted by two rows of units using glassware giving a fairly wide distribution of light. Sufficient diffused light



FIG. 15.-LIGHTING TYPICAL OF MILLINERY STORES IN THE SMALL-STORE CLASS

row and are best lighted by a single row of light units located over the counter. An extensive type of reflector should be used as the shelves and show cases which occupy both side walls and the principal planes of illumination with the counter as a secondary consideration.

Much can be done in the matter of illuminating this class of stores by having their lighting equipment dissimlar to drug stores and millinery shops. At present most of the lighting installations appear the same whether used in meat stores, lelicity stores, drug stores, or millinery shops, which condition is not consistent, to say the least.

will thus be provided for the shelves in addition to well distributed downward flux. The average watts per square foot found was I.O. We believe this value a trifle low, and would recommend using I.2 watts per square foot in calculations.

Dry Goods (Fig. 9). Very frequently in the small store of this kind goods hang from the center of the ceiling, and shelves line all sides of the store. A general illumination of a relatively high intensity for the little color matching which is done is necessary. The counter forms the plane of illumination, as all inspection of goods is done there. A good lighting arrangement for two counters is a row of



FIG. 16.—LIGHTING TYPICAL OF MUSIC STORES IN THE SMALL-STORE CLASS



FIG. 17.—LIGHTING TYPICAL OF RESTAURANTS IN THE SMALL-STORE CLASS 397

small tamps equipped with fairly wide distributing reflectors over each, furnishing localized general illumination. If, as shown in Fig. 9, the center of the room is occupied by a table, general illumination from a multi-arm fixture is applicable. The average watts per square foot found was 1.26. On account of the large percentage of white material on the shelves and hanging about the store, good results could be obtained with 1.0 watt per square foot, though an even

watt per square foot is sufficient for general illumination.

Haberdashery Stores (Fig. 11). As is the case in a number of other instances, a higher intensity of illumination is found in the front portion of the store, as most of the purchasing is done there and this arrangement also has some advertising value. Glassware, giving fairly wide distribution of light, spaced to give an approximate uniformity of illumination on the counter plane, serve very well. The



FIG. 18.—LIGHTING TYPICAL OF SHOE STORES IN THE SMALL-STORE CLASS

higher wattage could be employed to advantage with the use of better type of glassware and more generous location of suitable fixtures.

Florists' Stores (Fig. 10). A good arrangement is general illumination localized on the show cases. This is the more economical arrangement, as the intensity in the main portion of the store need not be high. Lamps equipped with prismatic or opalescent glassware of an artistic type serve well. The average watts per square foot found was 1.0. If only general illumination is used this type is suitable.

average watts per square foot found was 1.43; this average is a good working value.

Grocery Stores (Fig. 12). The shelves and counters here demand an equal amount of the light; and if the store is very narrow one row of single units using a wide angle or flared reflector. For a medium width store as shown two rows of single smaller units with fairly wide distributing opalescent or prismatic reflectors should be employed. The average watts per square foot found was 0.98.

Jewelry Stores (Fig. 13). Direct light of high intensity should illuminate

the counter. Lamps equipped with fairly concentrating glassware, located in a row over the counter, will accomplish the desired results, and there will be sufficient diffused illumination to light the showcase usually found in the rear of the counter, placed along the wall. Clear lamps, associated with glassware giving specular reflection, will give a brilliant light, and permit the jewels to sparkle. Another arrangement is the one shown in Fig. 13, viz., the use of crystal glass fix-

this lamp on the perside of the box to serve as a single lamp. The cashier's desk should also have a small local light. Meat markets, especially those of the small class, probably represent a type of store where individuality of treatment—pleasing effects—may not be absolutely essential. However, other higher types of small stores should not be likewise equipped as apparently is the case. Let a somewhat higher realistic ideal be chosen—at a very slight change in cost—



FIG. 19.-LIGHTING TYPICAL OF STATIONERY STORES IN THE SMALL-STORE CLASS

tures hung high, furnishing a brilliant general illumination. 1.54 average watts per square foot is good practice.

Meat Markets (Fig. 14). The walls on which the meat racks are located are the surfaces to be lighted, hence with a single row of lamps equipped with diffusinf reflectors hung about 9 feet (2.74 m) is necessary, or with two rows of lamps equipped with glassware giving a fairly wide distribution of light; these arrangements will provide sufficient direct light for the counter. A local light must be provided for the icebox, and it is well to have a small lamp wired in series with

which will insure satisfactory results to be obtained, which will assist in establishing individuality, and therefore place light on a somewhat higher plane than it now enjoys.

It was found that 0.9 average watt per square foot is a satisfactory allowance for this class of stores.

Millinery Stores (Fig. 15). The hats are displayed in high glass cases lining the walls, but all close inspection is done in the center of the room. Two rows of lamps equipped with glassware, giving a fairly wide distribution of light, will serve very well in lighting the show

13

at the same time ide good light for inspection. In the row s a single row of lamps equipped with an all glassware is applicable. A hat well displayed, with the appearance of the lady customer ily enhanced through the medium of isfactory lighting effects, assures a dy sale. Commonplace results do not g tly aid the disposal of merchandise at p attractive to the proprietor. It was found that 1.3 watts per square foot is a reasonably good working average.

with a rather dark paper; occasionally the are, however, interpersed with mirror. The dark walls require a wattage slig by higher than normal for a given illumnation. The room should be laid out in the regular manner for an even distribution on the working plane. As a rule restaurants are wider than most small stores; two rows of lamps are usually necessary. The average watts per square foot required is 1.1.

Shoe Stores (Fig. 18). The plane of



FIG. 20.—LIGHTING TYPICAL OF WINE AND LIQUOR STORES IN THE SMALL-STORE CLASS

Music Stores (Fig. 16). Shelves with boxes line the walls. The contents of the boxes are indicated by writing or printing on their faces. The light for this kind of store must be of a moderately high intensity, and a glassware equipment for the arrangement chosen should give a wide distribution of light. 1.05 watts per square foot will serve as a basis for making calculations.

Restaurants (Fig. 17). The tables are the places on which illumination is desired. The intensity of the illumination should be sufficient to permit one to read easily. Although the ceiling is usually write the walls are frequently covered

illumination here is about one foot above the floor, and there are secondary planes which are the surfaces of the boxes lining the walls. Sufficient light must strike these to enable the clerk to read the labels. Two rows of lamps with intensive reflectors serves very well. The customer's bench is usually located in the center of the room between the rows. Clear lamps are best as a direct light seems to make the leather appear to better advantage. A machine is usually found in the rear. It requires a local light with a proper steel reflector. The average watts per square foot required is 1.0.

Stationery Stories (Fig. 19). Much

the same conditions exist here as cigar stores; the walls are dark, ar one side is lined with shelves. The c is usually covered with a show ca. A row of lamps with intensive reflecto s over this will light the room well.

The average watts per square foot found was 1.02. This is about right,

Wine and Liquor Stores (Fig. 20). Barrels occupy the rear portion of the store; shelves, with bottles, are on the sides. The fixtures are usually decorative, and there is no definite plane of illumination, as the shelves and counter demand equal amounts. A distributing or extensive reflector is applicable. 1.2 average watts per square foot, the average found, is slightly high; 1.0 is a better working value.

GENERAL CONCLUSIONS.

From the few examples given above one may make the following classification and specifications for small stores:

1. Those stores which demand equal illumination on the side wall shelves and on the counters, such as Bakeries, China, Delicatessen, Drug and Grocery Stores and Meat Markets. If a store is of medium width,1 two rows of lamps with intensive reflectors, or one row of multilight fixtures with wide arms will be satisfactory; if narrow, one row of lamps with extensive reflectors.

¹The medium with stores we have in mind average 20 ft.; their lengths vary; 50 ft, may be considered the maximum length.

Some of the smaller stores occupy only half a city lot and are approximately 9 ft. wide, and stores of this width come under the narrow classification.

2 Those which demand good illumina-

tion on the count with a small amount of light 'ux on side walls, such as Cigar, " Toons, " Maberdashery, Jewelry, Lawn Broker and Stationery Stores, rows of relatively small lamps with intensive reflectors providing loc ized illumination with reference to counters, serve well.

3. Those stores which demand highest intensity on the wall surfaces and a low general illumination. Art, Music, Hardware and Paint Stores fall in this class. Two rows of relatively small lamps with intensive reflectors located close to the wall, or if very narrow, one row of lamps with distributing reflectors.

4. Those which demand diffuse gen-In this class are eral illumination. Clothing, Confectionery, Florist, Furniture, Novelty, Millinery, Tailor, Shoe, Trunks and Leather, Wine and Liquor Stores, and Restaurants. Decorative fixtures and equipment, or simple units arranged for even illumination on the theoretical working plane may be provided.

5. Those stores the illumination of which is a localized lighting proposition, as in Barber Shops, Hair-Dressing and

Manicuring Parlors.

The authors desire to take this opportunity of thanking Messrs. S. W. Van Renselaer and L. E. Voyer for their assistance in collecting the data given in this paper, also the photographic department of the New York Edison Company, through whose courtesy the photographs are printed.

The following table gives a summary of the wattage valves found and recom-

mended.

	No. inves-	Watts	s per square f	oot.—	Recom-
Type of store.	tigated.	Maximum.	Minimum.	Average.	mended.
Art stores	14	2.02	0.40	1.01	1.3
Bakeries		1.74	0.25	0.82	0.8
Barber		2.62	0.51	1.23	
Cigar		2.00	0.39	1.45	1.4
Clothing		3.12	0.27	1.37	1.5
Confectionery		2.38	0.26	0.97	1.0
Delicatessen		3.36	0.37	1.11	1.1
Drug		1.85	0.43	1.01	1.2
Dry goods		2.50	0.69	1.26	1.0
Florist		1.59	0.48	1.07	1.1
Grocery		2.73	0.30	0.98	1.0
Haberdashery		4.95	0.60	1.43	1.7
Jewelry		4.38	0.50	1.54	1.6
Meat markets		2.42	0.40	0.91	0.9
Millinery		4.16	0.30	1.28	1.3
Music		1.85	0.60	1.05	î.ĭ
Restaurant		3.20	0.42	1.08	1.1
		1.87	0.36	0.98	1.0
Shoe		2.40	0.45	1.02	1.0
Stationery		2.89	0.40	1.20	1.0
Willes and figuois	.,. 20	2.00	0.40	1,20	1.0

(Editor's Note.-The foregoing article was, in a somewhat different treatment, first presented as a paper before the Sixth Annual Convention of the Illuminating Engineering Society, September 16 to 19, 1912, at Niagara Falls, Ont., Canada.)

SOME · NOTES · ON · SEMI-SINDIRECT · LIGHTING WITH · GAS AND EFFECTIVE CLASSWARE

BY ROBERT F. PIERCE

The increased public interest in illumination has resulted in overturning many of the time-worn prejudices which have heretofore hampered the introduction of modern methods of illumination. As long as the public demanded brilliant light sources, in the pitiful delusion that brilliancy of source went hand-in-hand with excellent illumination, those installations which embodied to any great degree the ideas of the customer were apt to be excellent examples of "how not to do it." The more intelligent portion of the public is, however, beginning to appreciate the fact that brilliant light sources really indicate in most cases, extremely poor illumination, and more attention is being paid to the diffusion of light from large sources of low brilliancy. The vogue of indirect lighting, the tendency to substitute frosted prismatic glassware for clear, and the more frequent use of large spheres and bowls is a welcome indication of this healthful development.

Perhaps there is no way in which artistic considerations may be so easily and so completely satisfied as by the use of leaded glass bowls of pleasing design. If the glass is carefully selected, and the fixtures carefully designed, the efficiency of this system of illumination may be made high enough to meet all reasonable requirements, and, since illumination of the better sort is primarily an appeal to the artistic sensibilities, the slight sacrifice in efficiency required is, as a general thing, willingly made.

This system—frequently called Semiindirect Lighting—is particularly suitable for the 'zhting of residences and mercanlishments of the better class. For the former purpose rather more elaborate designs are naturally preferred, while less expensive fixtures serve for the latter.

Fig. 1 illustrates an inexpensive fixture of this sort, equipped with a cluster of inverted mantles, so arranged that when the unit is in place, the lamp parts are entirely concealed from view, from the ordinary plane of the eye. One good feature of this fixture is that the same bowl equipped with electric lamps presents substantially the same appearance, making it possible to install gas and electric units of uniform appearance wherever gas light-

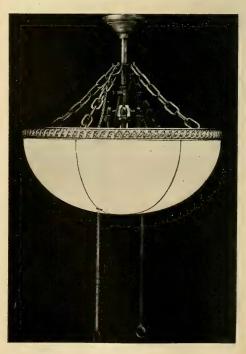


FIG. I .- SEMI-INDIRECT GAS FIXTURE

ing is installed primarily for alternative or emergency service, or in the case of combination companies' display rooms, where it is desired to exhibit the use of both illuminants in a uniform installation. Fig. 2 shows a recent installation of this character. The photograph gives an excellent indication of the quality of the lighting—soft, uniform, free from glare or objectionable shadows, and a pleasing, restful effect. Notice particularly the absence of blazing spots of light

read, the player's shacow being so slight as to introduce no inconvenience whatever. The normal illumination on music at the piano was 2 lumens per sq. ft. (or 2 foot-candles) with two lamps burning, indicating that under the conditions 1 lumen per sq. ft. was quite adequate. The effectiveness of this low degree of illumination was largely due to the very low brilliancy and large area of the light source.

The distribution of illumination from



FIG. 2.—INSTALLATION OF SEMI-INDIRECT GAS FIXTURES

which usually mark the location of lamps in photographs of ordinary direct-lighting installations.

Fig. 3 and Table 1 show the results of a test on a similar fixture installed in the living room shown in Fig. 4. The test was made with an equipment of two inverted gas lamps in the bowl the bottom of which was 6 ft. 2 in. above the floor. After the readings were taken, one lamp was turned out, and the effect of the resulting illumination noted. One was enabled to read comfortably in any part of the room, and music at the piano, though in the shadow of the player, was easily

this bowl is very favorable for residence lighting, giving a high intensity directly beneath the lamp, where those engaged in any sort of work requiring close vision are apt to gather, and shading off rapidly to the lower values at the edges of the room where subdued intensities are desired.

Fig. 5 and Table 2 show the results of tests in the dining room shown in Fig. 6 with three types of bowls, similarly equipped with two inverted gas lamps. The lower degree of illumination obtained in this case is principally time to the dark wall hangings.



FIG. 4.—LIVING ROOM



FIG. 6.—DINING ROOM
404

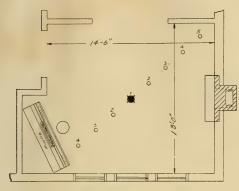


FIG. 3.—PLAN OF LIVING ROOM

In fixtures of this character, much depends upon the quality of glass used, the form of the bowl, and its position relative to the primary light source or lamp. The fixtures shown herewith are of white equalite glass which has a very pleasing appearance when lighted up, and good reflecting and good diffusing qualities. If a warmer tone is desired, it is better to use amber mantles than to resort to the use of colored or tinted glass lacking the peculiar properties required for lighting of this sort. Ordinary art glass may, however, be used for embellishment of the design or otherwise introducing a variety of colors, but the body of the bowl should be made of glass having good diffusive and reflective qualities.

The commercial possibilities in fixtures

of this character should not be estimated from their mere efficiency in producing measurable illumination. In many cases, in fact in most cases, where artistic considerations enter at all, they are of paramount importance. It will be found that much desirable business altogether unobtainable with "stock" or ordinary commercial fixtures may be gotten by properly presenting the advantage of the semi-indirect system. Its novelty and attractiveness alone will often obtain its adoption.

Business obtained upon this basis is more apt to be secure from competition, and to be lucrative to the lighting company, than business obtained purely upon grounds of economy.

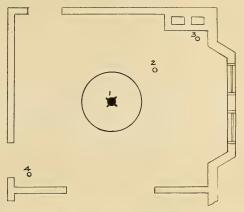


FIG. 5.—PLAN OF DINING ROOM

CAB	LE	1
-----	----	---

		illumination (ir	
	above flo	oor) in foot-can	
Testing	Bowl	Bowl	Bowl
stations.	No. 4606	No. 4580	No. 4536
1	7.9	8.2	7.2
2	4.6	5.1	
$\frac{2}{3}$.75	.9	
4			.9

Remarks.
Ceiling 9 ft. 6 in. high.
Bottom of bowls about 5 ft. 6 in. from floor.
Walls, dark green.
Ceiling, cream yellow.
Each bowl was equipped with two inverted gas lamps.

TABLE 2.

	Horz, foot-candles (in plane 30	Normal
Stations.	in. above floor).	foot-candles.
1	11.0	
2	6.0	
3	3.3	
4	1.84	2.8
5	1.2	

Remarks. Normal foot-candles on music at piano, 2.0. Two inverted gas lamps used. on indirect II' building or'v vestigatio rect, sem lighting a In orde of illumit quirement. Filene Bu floor shor and tot matic sing, a reflector.

NTRIBUTIONS

THE EDITOR solicits—subject to approval and without obligation—original manuscripts for use in GOOD LIGHTING.

- Articles of an interesting and instructive nature—well illustrated—dealing with average and unusual conditions—uniquely administrated to—away from the monotonous commonplace—are most desired.
- GOOD LIGHTING treats with all phases of Light—both natural and artificial.

WY FILENE'S SONS COMPA BVILDING - BOSTON, MA



The beautiful new Filene Building stands 125 feet above the street level, the Boston Building limit, and has frontages of 149 feet on Washington Street, 223 feet on Summer Street and 150 feet goods being carried. Every provision habeen made by the owners for the care and comfort of customers and employees. In fact, this is one of the finest stores of its kind in the country.



D. H. Burnham & Co., Architects.

FIG. I .- FILENE BUILDING, BOSTON, MASS.

on Hawley Street. The building is of modern fire-proof construction. Eight floors are above ground and three below, housing 2,500 employees.

The building is devoted entirely to the sale of men, women and children's wearing apparel and accessories, no yardage Indirect illumination is used throughout the entire building with the exception of the balconies, stairways, restaurant, outside entrances and sub-basement. In the latter areas suitable direct lighting equipment is installed.

Wm. Filene's Sons Company decided

on indirect llumination for their new building or by after making a thorough investigatio a of the various systems of direct, semi-indirect and totally indirect

lighting a ppliances.

In order to determine the best system of illumination for their particular requirement's, they had installed in the old Filene Building in each of three main floor shores systems of direct, semi-indirect and totally indirect respectively. Prismatic glassware was used for direct lighting, and translucent bowls without any reflectors for semi-indirect. For indirect two appliances were considered, namely, a steel bowl white enameled on both sides, without any reflectors, and one-piece pure silvered glass reflectors arranged in suitable holders.

The Filene Company realized that any system of illumination to be a commercial success should appeal both to the consumer and employee. Largely for this reason they were the judge in deciding upon indirect lighting for the new build-

ing.

The manufacturers of the indirect lighting appliances made various claims which were conflicting. In order to prove

or disprove these statements the architects, D. H. Burnham & Co., Chicago, had extensive tests made under their supervision, the findings of which were unanimously in favor of system selected.

ENGINEERING REPORT FOR LIGHTING EQUIPMENT.

Basements.

Main Floor.

A direct lighting system was specified on account of numerous pipes, etc., on the ceiling, obstructing the reflecting surface for the indirect system. The writer understands, however, that the owners have gone to considerable expense to hide the pipes so that indirect lighting can be used.

neight of centing
No. of bays
Size of each
Area440 sq. ft,
Clear bulb tungsten lamps per fix-
ture
Watts per square foot2.02
Approximated foot-candles5.25
Outlets per bay1
ReflectorSilvered glass
Distance from top of reflector to ceiling60 in.
Second Floor.
Height of ceiling
Remaining data same as main floor except
distance from top of reflector to ceiling 42 in.
Third to Sixth Floor, inclusive.
Height of ceiling14 ft.
No. of bays per floor53
Size of each

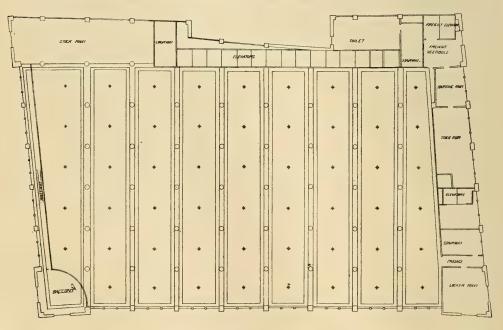


FIG. 3.—TYPICAL CEILING PLAN TO SIXTH FLOORS, INCLUSIVE, SHOWING LOCATION OF OUTLETS FOR LIGHTING FIXTURES.



FIG. 2.—TYPICAL FLOOR

Area440 sq. ft
Clear bulb tungsten lamps per fix-
ture6—100 wat
Watts per square foot
Approximated foot-candles
Outlets per bay
Reflector Silvered glass
Distance from top of reflector to ceiling36 in

Seventh and Eighth Floors.

No data will be given for these floors, as they are broken up by numerous offices, clerical departments, recreation rooms, etc.

The indirect system is used throughout with the exception of the restaurant on the eighth floor, where a large skylight did not work out to the best advantage for indirect lighting.

REMARKS.

Wherever direct lighting was used great care was taken to hide the filament of the tungsten lamp. On the balconies this was accomplished by using heavy density opal shades and frosted tip lamps placed at the ceiling. In the stairways and restaurant tungsten lamps were encloed in prismatic hemispheres.

The tendency being throughout the building to illuminate all exposed light sources and obtain the greatest possible diffusion.

The interior decorations throughout the building are light in color. The prevailing scheme being a very light shade of cream for ceiling, walls and columns down to the cases. The woodwork, cases, etc., is of mahogany.

Lighting Fixtures.

Indirect reflectors are made of onepiece glass with vertical and spiral corrugations, plated with pure silver, protected by an elastic enamel. Being fire glazed they are easily cleaned and, due to the method of construction, their efficiency is as great after years of service as when first installed.

All show windows on the main floor and basement facing on the subway are equipped with one-piece silvered glass reflectors. Over five hundred window reflectors are used in this installation. The reflector is designed for windows of average height and depth. Being opaque it hides the lamp from view and throws the majority of the light flux into the window, not allowing a large waste on the ceiling, background and side walls.

OLD LAMPS FOR NEW

Drawings by Edna Hood Lissak (Republished through the courtesy of the New York Edison Company)

From the East has come spiritual light in forms both good and bad, and the debt is being paid in Western illuminants. Some occidental genius applied brains to the problem and a screw to the lamp wick. Another enclosed the flame in metal; a third made the chimney of glass; then somebody thought of modifying the lamp

to admit of a double current of air, and in 1765, reflectors were sometimes added, at least to lanterns. Thereafter the changes were swift and spectacular, a statement which applies rather to the nature of the illuminants than to the form of the lamp. For aside from slight modifications sioned by changes in the illuminating material, or by increasing perfection mechanical ingenuity, the development of lamp forms followed, as before, the architecture of the successive periods.

As early as 1650

gas had been discovered by a Belgian chemist, but religious scruples stood in the way of its kindly reception. Its name, derived from the German, geist, somehow suggested evil, and the superstition

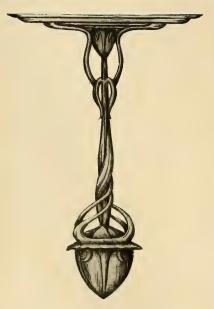
of the time caused its rejection, although it was occasionally used for lighting as early as 1772. Meanwhile a Frenchman, Phillipe Lebon by name, had invented the thermo-lamp, which was supplied with gas obtained from decomposing wood subjected to a high temperature, but its impurities and its disagree-

able odor rendered it obnoxious as an il-A little luminant. later, William Murdock provided a substitute for wood, and established a system of lighting in a manufactory at Soho.

Lighting by means of petroleum and other hydrocarbon liquids was a phenomenon of comparatively late development in the history of illumination coming toward the middle of the nineteenth century. With the discovery of these materials and of acetylene the world became brighter, but always the malodorous quality of the one and

the explosiveness of the other made it evident that perfection in the art of illumination had not been reached at that time.

In the first decade of the nineteenth



A SUGGESTION OF L'ART NOUVEAU. HANGING LAMP ADAPTED TO MODERN LIGHTING.

century it was known that electricity could be made serviceable in lighting, but its value was not clearly recognized until 1844, and street lighting bv this means, which cannot taken as an index of its general use, did not come until 1878. One cause of the delay was the lack of satisfactory filament. Platinum and irridium were



ROMAN LAMP OF THE FIRST CENTURY AR-RANGED FOR ELEC-TRIC LIGHT.

at first the only materials believed to be suitable, and the carbon lamp, which revolutionized methods of electrical illumination, did not come until 1878. In



A MODERN LAMP.
DRAWN FROM AN
EARLY GERMAN
DESIGN.

1882, the world's first station for the production of electric lighting was put in operation by Thomas A. Edison. Nearly twenty years later the Osmian lamp was invented, but the fact that the filaments were very brittle, when cold, caused much breakage transit. while at working temperatures they were soft,

and could thus be used only in vertical position. In this connection, the great superiority of electricity over other forms of illuminant may be noted. For with



ROMAN BRACKET LAMP. PROVIDED WITH AN ELECTRIC LIGHT, IT WOULD BE WELL ADAPTED TO A MODERN DEN OR LIBRARY.

the modern tantalum and aungsten filaments the lamp may be placed in any

position; hence the number of possible forms which the lamp may now take is limitless.

But tantalum and tungsten are comparatively recent discoveries. While the former has demonstrated its serviceability as a filament, the latter has proved to be without a peer, its great brilliancy, its low con-



LAMPE OPTIQUE (1757).

CALLED BY THE INVENTOR AN ELECTRIC LAMP.

sumption of power, and the fact that the tungsten lamp seldom blackens being among the qualities which give it this foremost position.

At last the lamp in its evolution has arrived at a point where its form is wholly independent of the contained material, and dependent only upon the designer's ability to harmonize the lamp form with the other decorative features



BYZANTINE LAMP, WITH CURIOUSLY CARVED LEGS.

of the interior for which it is designed. As in the composite architecture of the present period classic and mediæval models are copied and readapted to present uses, so the form of the lamp and all lighting fixtures reflect the periods through which the human race has passed in its struggle with darkness.



THREE-CANDLE BRACKET OF THE EMPIRE PERIOD. THE LOTUS LEAF AND GENERAL DESIGN SUGGEST THE EGYPTIAN INFLUENCE DOMINANT AT THIS TIME.

Go into any of the larger establishments of the city which are devoted exclusively to the production and sale of this class of ornaments and abundant evidence of this presents itself. With the aid of a competent guide or of an informed historical sense, you will be able to trace in the seeming confusion an orderly succession of lamp forms, each expressing the taste of some particular age or reflecting its dominating conception of beauty in architectural design. Here, for instance, is a heavy German lamp which may have formed part of the furniture of some early baronial castle, its straight Gothic lines relieved by grotesque figures suggesting a date earlier at least than the fifteenth century. Some of these Gothic lamps and candelabra were of extreme beauty, by the side of which the ornate forms of the Louis XV period look tawdry and insignificant,

Nearby is a beautiful Venetian hang-

ing lamp, designed from the original which once lighted a palace on the Grand

Canal. Now, studded with lights, electric whose form enhances the beauty of the original decoration. awaits an owner to grace the interior of some sumptuous American In anpalace. other room, perhaps, you will see bracket candlesticks of early Renaissance design, side by side with those of Louis XIV., XV. and XVI. pattern, and rococco forms, expressing exuberant fancy of still later times. Lamps of the Empire period are there also, showing in their lotus leaves and animal form the influence Egyptian art, while simpler lines reveal the later revival of classic models.

Each and all of these lamps, whether ancient or modern, of European or of bizarre oriental design, lend



FLORENTINE TORCHERE OF CARVED WOOD, FIRST USED IN RELIGIOUS RITES, IN ITS MOD-ERN FORM, THE STANDARD IS COVERED WITH VELVET.

themselves gratefully and gracefully to the modern illuminant. Evidence of this may be seen in the accompanying cuts, four of which, exhibiting lamps of different styles and periods, are shown.

(Note: Four of the cuts shown are through the courtesy of the J. B. McCoy Company, of New York City.)

Individuality in Store Illumination

by Robert B. Ely

Since the introduction of the metalized filament lamps and the later development of the tantalum and tungsten lamps, Electric Lighting Companies and Gas Companies have had to meet a demand for improved lighting facility. The storekeeper and the public generally are being educated relative to the difference between light and illumination.

The increasing brilliancy of our light sources has demanded greater care on the part of the designer of a lighting installation, to so place and shade these sources of light, so that they will not only serve their purpose, that of illumination, but they must protect one of our greatest as-

sets, the sense of sight.

The up-to-date store keeper will arrange his system of accounts in a manner best suited to his particular business, and generally there will be a difference between his system and that of his competitor. Then you will find the arrangement of his store fixtures, furniture, floor covering, and wall decorations different. This is why his lighting equipment should receive individual treatment. It is inadvisable to depend on a rule-of-thumb method of lighting on the basis that J. Jones and J. Smith each have grocery stores, and they are illuminated in a manner, at a certain current consumption per square foot. It does not necessarily follow that Mr. Johnson's store should receive the ready-made or similar equipment. You have probably read of the man who could describe the general character of man by looking at his shoes. This man could take a lot of

old shoes and describe in a general way the character of the wearer. This, no doubt, required some study. A store will be judged to a great extent by its illumination, or lack of illumination. For instance, you readily notice the shoddy shop among the high class stores in the late afternoon by the character of the lighting equipment. In the case of a small café or restaurant we judge the character of the place largely by the illumination and furnishings before deciding to dine in that

particular place.

The layman will not make a study of lighting equipment to determine the character of a café or store. He simply senses these things. It is to a great extent the inconspicuousness of the lighting equipment that attracts. It is the physiological effect of the illumination of the interior. It is, therefore, necessary to try to obtain this effect, and in each and every instance the decoration, furniture, and surroundings governing to a great extent the equipment for the very small store, as well as that for the palace. The accompanying illustrations show the individual treatment as given in a wall paper store, in which wall papers of from five to ten cents a roll are sold. The location and the general appointments of the store were such as to have the tone of a high class establishment. The facilities with which their complete line of papers can be shown is worthy of mentioning.

Unfortunately the photograph of the interior was taken before the settees and tables were placed in position, as they improve the general appearance greatly.

Figure 1 shows the show window illuminated. The illumination is accomplished by the use of 12-100 watt tungsten lamps, spaced in three (3) rows of four (4) lamps each. The lamps being equipped with comical shape silver plate glass reflectors, and the lamps are controlled by a time switch.

Figure 2 shows the interior. The general illumination is effected by five (5) indirect lighting fixtures, each fixture being equipped with 5-100 watt tungsten

lamps, and silver plated glass reflectors. These fixtures are spaced about twenty-five (25) feet apart. The wall paper samples are hung on movable screens and are illuminated by 52-25 watt tungsten lamps concealed in a projecting cornice over the wall paper racks. The reflecting surface being a concave tin surface extending the entire length of the rack. The apparent brightness at the top of the rack, as appears in photograph, is largely due to the light colored borders



FIG. I.—INTERIOR OF STORE.



FIG. 2.-EXTERIOR OF STORE.

on the wall papers on each screen. The small store that is illuminated in a different and individual manner is a business getter, and is well worth the cost of individual consideration by one capable of designing the lighting installation, and such an installatio will generally be far more economical.

Grading Headights by Photography

The camera as an aid in choosing fittings for motor cars has been called into successful use at an auto plant at Buffalo. It was necessary to make a choice between several kinds of headlamps, and road tests at night were not considered infallible in result, because of the possibility of differing weather conditions. So the camera was called upon.

On the night of the camera test a large screen was placed against a blank wall and the car from which the test was made was stationed some little distance away, facing the screen. The camera was placed in a fixed position. As each set of headlights was fixed to the supports on the car and the lights switched on, two photographs were made: One of the screen alone, to show the projection of the lamp's rays, and the other of the ground between the lamp and the screen, to illustrate the diffusion. All the exposures were made under exactly the same conditions, the plates were all well developed together and the prints made together. In this manner the photographic prints gave an accurate idea of the comparative lighting power of the various lamps tried out.



GLARE

The defining of this too generally apparent, disturbing and destructive condition seems to be a difficult matter. However, after all, we are more concerned in its *elimination* than in its definition.

Glare, resulting from the use of glazed (calendered) papers, and glossy inks, is much too prevalent—of this there is no doubt.

Observe the character of the paper and ink used in GOOD LIGHT-ING—and the lack of glare.

The effect is more agreeable to the eye. It is also artistic.

We will present shortly an even greater advancement in the art of printing. Look for it!

MOVING PICTURES AND THE EYES ON M.E. HART

The cinematograph has for its principle the persistency of luminous impressions on the retina. The impression made by light on the retina does not cease the instant the light is removed, but persists about one-eighth of a second. If the luminous impressions are separated by a less interval, they appear continuous. In the cinematograph projection, the pictures are thrown upon the screen at the rate of 16 a second and though this apparently shows continuous motion, such is not the case. An infinitesimal period of motion is lost between each successive picture in the short period when the lens is closed to admit of the successive section of film being jerked into place behind the lens and although the eye does not realize the motion that is lost, yet it still has an impression of lack of continuity, colloquially described as "flicker," attributed to cutting in and out of the shutter, but which is in reality nothing more than the sharp line of demarcation between each period of movement, as represented by its individual instantaneous picture.

The average cinematograph performance lasts from three-quarters of an hour to an hour and is it a wonder that we get ocular disturbances after subjecting such a sensitive membrane as the retina to such fatigue? These successive excitations exhaust the sensibility and disturb the physiological function of the retina.

The ocular disturbances, classified under the generic term of "cinematophthalmia," are really disturbances of vision due to traumatism, and are matters of degree. The process is the same in all of the conditions. There are those cases which are merely transient in their disturbance. When the picture is first thrown on the screen the individual is inconvenienced by photophobia and a few tears. He closes his eyes and these symptoms soon pass away after a few seconds of repose and

the retina accustoms itself to the new condition of affairs. A further degree is of longer duration; the retina cannot adapt itself to the fatigue imposed on it and each time the individual opens his eyes the symptoms reappear. It is impossible to continue the spectacle. After leaving the theater the disturbance still persists and in addition to the mild photophobia and lacrimation there ensues a slight reddening of the conjunctiva. A few hours, or at least a night's rest, will return the eyes to their normal tone.

In the third degree of disturbance the symptoms are more severe and the return to the normal somewhat prolonged. Here the photophobia, lacrimation and conjunctivitis persists for several days and in addition we have a smarting and itching of the eyes.

In the very severe cases, besides the inflamation of the conjunctiva with its attendant symptoms of lacrimation and photophobia, we have very definite asthenopic symptoms, both accommodative and retinal—the former due to the ciliary strain and the latter due to a hyperesthesia of the retina. The distant vision remains normal. Under examination these patients are found to have no error of refraction or lesion of the fundus. A case in question may here be cited:

"E. R., age 16, was brought to me with the following complaint: Eyes burned and itched and the lids were red, particularly at night. Reading was impossible on account of blurring of the page. No headaches. This condition would clear up after a night's rest, to reappear again at frequent intervals.

On examination a slight reddening of the conjunctiva was found and under a mydriatic an error of one degree of hyperopia, which was corrected. The near point was normal, showing no error of accommodation. Of course this was tested h re using the mydriatic. No lesion of e fundus was found. Unfortunately the patient could not be seen during an attack.

After wearing the glasses for several weeks the patient reported, stating that the condition had not improved. She was then closely questioned and it was found that it was her habit to attend a moving picture show at least four times a week after school and unbeknown to her mother. She was forbidden this amusement and the condition entirely cleared up.

Fortunately these ocular disturbances are not serious and will clear up under

simple collyria and rest.

The question will naturally arise, how can we do away with the cause of the trouble?

First.—The films must be perfect and free from all imperfections. We have all noticed the scratches on the pictures, particularly at the end of the reels, due to careless handling. When we realize that the average picture thrown on the screen is about 97,000 times larger than the original size of the individual film we can appreciate that even the smallest blemish on the films will be tremendously magnified on the curtain and will have a correspondingly bad effect on the eyes.

Second.—The illumination must be steady, must not vary and must neither be too bright nor too dim, for this causes

fatigue.

Third.—The speed with which the films are turned must be regular. Any irregularity will have a tendency to cause ocular fatigue.

Fourth.—The position of the spectator is very important and should receive proper regulation at the hands of the authorities. First of all, there should be no seats placed at the sides of the auditorium. Every seat should be in direct line with the curtain. This will do away with the distortion of the picture. Anyone who has had the experience of sitting on the side can appreciate the intense strain and fatigue placed on the eyes.

No seat should be place nearer than 20 feet from the screen and further if practicable, depending upon the size of the picture on the curtain. This will do away with any accommodative effort on the part of the spectator and thus will reduce the fatigue to a minimum. The nearer the screen the greater the fatigue, so the seats at the rear of the auditorium are the best.

The effect of the cinematograph on the eyes finally depends upon the individual himself. Some persons can attend daily without evil results, while others cannot stay through a single picture without ocular fatigue. This depends to a great extent upon the nervous predisposition and those with this idiosyncrasy should remain away from the cinematograph. But will they?

Searchlights to Guide Fishing Dories

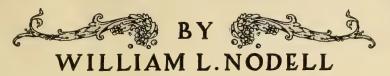
Electricity is now rendering a little less dangerous the operations of the fishing fleets of the North Atlantic coast, whose men brave perhaps more dangers than any other class of workers. An electric searchlight—a modification of the well-known electric automobile searchlight—has been installed upon almost every vessel of the Gloucester and T-Wharf fishing fleets, and although these lights have been in op-

eration less than a year they have already been instrumental in saving several lives.

The searchlights take the place of flare torches on the vessels. The new devices are powerful enough to pierce the thickest fog or darkest night for a long distance, and at the same time are small and light enough to be carried by hand from place to place about the vessel.

How numerous the uses of light!

A PRACTICAL ILLUMINATION DESIGN FOR A SHOE STORE



The writer was recently called upon to redesign the illumination system of a shoe store on Market Street, Philadelphia. This bootery, which is one of a chain of such establishments owned by Mr. P. T. Hallahan, had previously been illuminated by gas. The writer's task was to install an electric system which would give the most satisfactory results obtainable. The chief problem, it was soon discovered, was to get a light that would not cause glaring, confusing reflections from polished shoes or slippers, when the latter were being tried on by prospective purchasers. To overcome this difficulty, and at the same time to accomplish good general illumination, it was found that bowl frosted tungsten lamps with satin finish focusing prismatic reflectors offered the best advantages.

The store is really a double one with a single central entrance. Ten feet from the door is a central wall extending to within 15 feet of the rear of the store. One side is devoted to the sale of men's shoes, the other to women's. The entire length is 125 feet and the width of each department 20 feet. The height is 15 feet. In the accompanying photos is seen a 3 ft. balcony 6½ ft. from the ceiling which commences about 38 feet from the front in each department, and extends to the rear, where it is 10 feet wide along the back wall. The finish of the woodwork, balcony railings, etc., is fumed oak, and is almost black. The ceiling is dark cream. The frames of the chairs are black with dark green leather seats and backs. The carpet is dark green.

On account of the absorption of light by such dark furnishings, sixteen 250-

watt bowl frosted tungsten lamps and eighty 25-watt round bulb all frosted tungsten lamps were used. In the ladies' department eight 250-watt lamps averaging 13 feet apart in a central line were hung at a height of about twelve feet from the floor, the first lamp being 15 feet from the front. On the men's side there are seven 250-watt lamps spaced about fifteen feet apart. One 250-watt lamp is hung about 5 feet from the front on a line with the center wall. The frosted 25-watt lamps are used under the balconies, and serve a decorative purpose as well as to overcome the shadows thrown by the balconies. Facing the entrance and adjoining the front of the central wall is a tall show case (not shown in the photos) which is lighted at the top with 25-watt round bulb tungsten lamps concealed by light curtains. In the front of each department are show cases lighted by 25watt tubular tungsten lamps. cases present a very pleasing effect as the displays consist of assortments of stockings of various colors, tastefully arranged. They are partly seen in the foreground of each view, but were not lighted when the picture was taken due to their closeness to the camera.

There are two windows 18 feet wide by 7.5 feet deep, and the floor is about 24 inches above street level. Each window is lighted by eleven 60-watt and six 100-watt clear tungsten lamps using clear concentrating prismatic reflectors at an angle of about 30 degrees from the vertical. The lamps are entirely concealed from the street. On week-day evenings the sixty-watt lamps only are burned; on Saturdays the 100-watt lamps are added.



STORE INTERIOR.

The window lighting with the sixty-watt lamps alone is effective, and when all the lamps are on, the "Hallahan windows" certainly proclaim their desire to be seen to a degree that puts their competing neighbors quite in the shade.

Extending across the sidewalk to the

curb, the full width of the store, is a marquise under which are hung four prismatic-opal street lighting units using 100-watt tungsten lamps.

Hallahan is a shoe-man who appreciates the sales value of artificial light—and I wish there were more like him.

Shooting by Searchlight L.

It is always a pleasing spectacle to watch searchlight drills at night, either from shore batteries or battleship fleets. But a real, live target practice by searchlight, with solid shot and targets carrying red lights, is a bit of the spectacular one can't find in a wild west show or a circus.

These lights are powerful and throw a brilliant beam for long distances out to sea. They are so powerful that the gunners are able to find the target at night while it is being towed by a tug at a fast clip at long ranges. When once spotted the bombardment begins in ear-

nest. Shooting big twelve and sixteen inch guns at night is no work for children, and practise at this time is more or less dangerous, not only to the gunners in the batteries and the men on the tender doing the target towing, but it is extremely hazardous for shipping, especially to small pleasure craft.

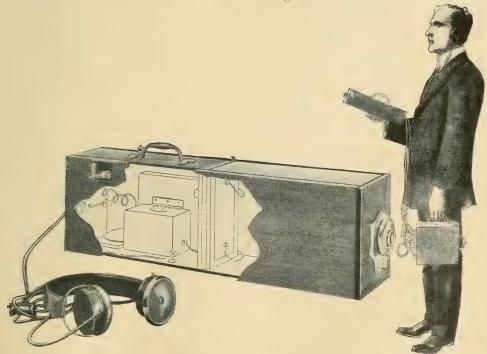
Some good records have been made shooting at targets at night by the aid of searchlights, and in time of actual warfare with a big target like a moving dreadnaught the artillerymen feel that they can "hold the fort" longer than did the Russians at Port Arthur.

The Blind May Now "Hear" Light

Hearing the "sound" of moonlight appears a fantastic notion without commonsense foundation, but that such a thing is possible is the claim made by Fournier D'Albe, of the Birmingham (England) University, the inventor of the "optophone." At a recent test of the instrument, given in London, the value of the device for blind people was demonstrated.

The optophone is a small camera-like box, open at one end, which, if pointed at the light, causes the instrument to produce sound which is transmitted by sensitive receivers of the type used in telephones. The accompanying illustration shows a blind man turning around, with the instrument in his hand, in order to ascertain the location of a window. The different tones, and degrees of sound, enable the user of the instrument to deter-

mine the character of the body passing between him and the light. By aid of the receivers the man shown in the picture was able to count six people who passed in front of him by the intervals of light between them. "On a moonlight night," asserts the inventor, "you can hear the moon and when the sun is shining you would recognize it by the tremendous noise it would make." Besides this use of the optophone, Mr. D'Albe expresses confidence that the invention will prove useful in discovering the light of stars that are not visible, as well as in many other directions. The invention is based on the well-known property of selenium of changing its electrical resistance under the influence of light. For three years Mr. D'Albe has been at work in perfecting his invention.



AN APPARATUS THROUGH WHICH THE BLIND ARE ENABLED TO LOCATE LIGHT BY MEANS OF SOUND.

IT AIDS THEM, FOR INSTANCE, TO LOCATE WINDOWS AND OPEN DOORS

STREET ILLUMINATION





Street illumination, as found in towns of seven to ten thousand population, is frequently of low order, due to incompetency in the selection of equipment and lighting units, to insufficient knowledge of proper lamp locations for best results, and to the fact that the lighting units are of an old and obsolete type of illumination.

main street necessitated the use of many automobiles and heavy trucks. A number of the outlying streets were also used for the same general purpose, while the remaining traffic consisted largely of automobiles and carriages in ordinary use.

The general contour of the outlying streets was more or less hilly, and many of them were winding in character, caus-

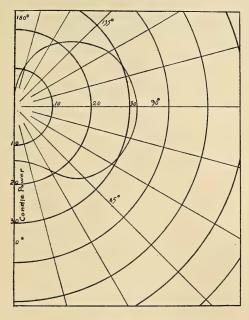


FIG. I.

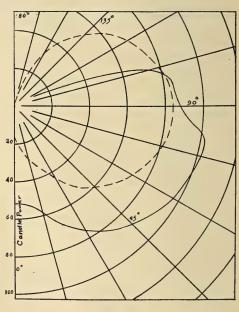


FIG. 2.

A manufacturing town of some eight thousand inhabitants, lying in the Middle West, was made a source of study in this connection.

With the exception of the main street, which was paved with stone blocks, all the streets were oil-coated macadam, and in a fair state of preservation. The prevalence of factories and business houses on the

ing many intersections other than right angles. They were lined on both sides with large overhanging elm trees.

The main street lay in an irregular line for about a mile along the river front, while the outlying streets totaled approximately fifteen miles. Several small parks and recreation centers were scattered throughout the town.

The energy required for street, as well as house, illumination was derived from a comparatively small stream. This was of ample power to supply the current when harnessed to a 250-horsepower water turbine and belted to the various machines. The rainfall was sufficient to supply full motive power for nine to ten months of the year without help from the auxiliary outfit, and 75 per cent. of the total energy for the remaining two or three months. The arc lamps operated from a Brush arc machine, 6.6 amperes, 125 light capacity. The house service was operated from a 150-kilowatt, 2200volt, 60-cycle alternator. The regulation on the arc machine was well within ± five per cent.

The lighting company, being also a gas company, had equipped itself with an excellent auxiliary outfit of two steam turbines, each capable of operating a 100kilo-watt, direct connected generator. The boilers used for these steam turbines were ordinarily used for the manufacture of gas, but were of sufficient size to take care of both gas an electric lighting. There were two exciters, one steam and the other electric driven, each of which was sufficient to carry both generators. station was excellently equipped with the proper meters, rheostats, busses, etc., for good operation. The water power station was also equipped with a three-phase induction motor which might, in case of water shortage, be operated from the turbo-electric plant, and belted to the Brush arc machine, using the available water power energy for house service by synchronizing the water power generator with the turbo-electric plant.

For a town of this size, it was quite remarkable to note that the 4000-hour schedule was maintained. In fact, the lighting company had frequently exceeded this schedule by 75 to 100 hours.

The only form of contract entered into between the lighting company and the town was a tentative agreement that there should be at least 100 arc lamps of the type known as 1200 c.p. or their equivalent, to cost \$75 per lamp per year; including all maintenance, repairs, etc; that there should be at least thirty 32 c.p. incandescent lamps at \$20 per lamp per year; that any additional lamps required

by the city should be installed and maintained at the regular rate per lamp. Further than this, the lighting company had no assurance that the number and type of lamps might not be radically changed from year to year, or that the city might not install a municipal plant.

An inspection of the street lighting system revealed the fact that the 105-6.6 ampere, direct current, open arc lamps were operating as satisfactorily as could be expected of that type of lamp. Each arc lamp was equipped with a clear globe and painted reflector, while in most cases, the incandescent lamps were mounted with no reflector at all, and totally unprotected from the weather. The illumination as given by these lamps was used only for the purpose of lighting the entrances to several of the municipal buildings, such as the court house, fire houses, etc., and in some cases, for park illumination.

The majority of arc lamps were mounted on poles immediately over the curbs and in many cases were in such position that the only illumination which reached the street was that thrown directly downward, a large proportion being lost in the surrounding foliage. The agreement which the town had with the lighting company was such that the location of any lamp might be changed or a new one installed by the petition of a certain number of persons to the lighting board. If this board approved, a similar request was made to the lighting company. Thus, it was found that many seemingly important street corners and street areas were wholly without illumination, while in some districts where the streets were winding, it was possible to lose sight of one lamp before the next appeared in view, showing the necessity for a concerted action on the part of a lighting board, considering the question as a whole, rather than individuals concerned only in their own welfare.

The distribution of light about the units used is shown in Diagrams Nos. I and 2. Diagram No. 3 shows the illumination over a typical area in the main street, where adjacent arc lamps were placed on opposite sides of the street, and comparatively close together. The illumination data bears out the general form of the distribution curves in that the illumination

ination is he lamps and dimitishes rapidly coward the points midway between lamps. It will be noticed that the illumination is high near the curb and much less toward the center of the street. This may be accounted for by the storewindow illumination which augments the arc lamps. Figure No. 4 shows a typical outlying street area, where the distances between arc lamps was great, and the trees became a formidable obstacle for the illumination intended to reach the street between the lamps.

In a few localities, the arc lamps appeared to be lacking in candle-power and

people wherever possible. This might be explained in part by the fact that the lamps used were so antiquated that it was impossible to purchase renewal parts, and further, the lamp maintenance was equivalent to a greater sum than the interest on the investment of a new type of lamp of a higher efficiency, having a longer burning period between trims. The arc lamp carbon life being but thirteen hours necessitated daily retrimming and an inspection each night in order to secure proper lamp operation.

With careful study of conditions and facts in hand, a new contract was drawn

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FIG. 3. ILLUMINATION VALVES OVER STREET.

the majority were improperly located. It will be seen that the agreement between the town and the lighting company was of a character to aggravate suspicion and discontent on the part of the townspeople and any effort toward improvement or change in the system by the lighting company was regarded as a move toward curtailment of expense and substitution of an inferior illuminant. The suspicion and discontent of the people led to a town meeting at which it was decided to call in expert advice for the purpose of drawing up a new contract, designating new and better lighting units and making a general redistribution of the illuminants.

It was found that the lighting company was anxious to co-operate with the towns-

up to cover a period of five years. Special attention was given to the following points:

The entire old system was to be considered obsolete and the new system should consist of both arc and incandescent lamps; the arc lamps to be 6.6 amperes, direct current series magnitite, with clear globes and white porcelain enamel reflector; the incandescent lamps to be 100-watt, 6.6 amperes, tungsten street series with "radial wave" and special parabolic reflectors.

A complete redistribution of lamps was to be made, locating twenty-six magnitite arcs on the main street, hanging them from mast arms wherever possible, so situating them that they would hang over the

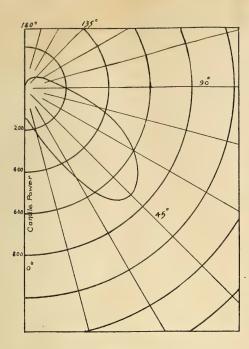


FIG. 4.

center of cross streets and over the center of streets between blocks; their location to be as shown on a map supplied by the city and their height to be governed by surrounding objects, such as trees, trolley and telegraph wires, etc. In outlying districts, for each arc lamp under the old conditions there was to be substituted at least three 100-watt street series tungsten lamps in special white enamel reflectors of the four-way parabolic type on the street corner and the two-way parabolic between blocks. In the parks and open areas, the "radial wave" reflector was to be used. The total number of lamps was to be increased from 75 per cent, to full capacity of the Brush arc machine. It was found that this change could be effected without materially increasing the lighting appropriation, as the lighting company preferred to operate their machine at full capacity.

The inspection of all lamps was to be the duty of the police department. Any lamp reported before nine o'clock in the morning as out for the night previous was to be put in commission for the following night and every hour of schedule time thereafter that the lamp failed to burn should be considered as outage, and a deduction

made accordingly. use of 150hour arc lamps and the police inspection system, it was found possible to make a material reduction in the cost of maintenance, as under the old system, it was found necessary to keep a man with a horse and wagon to trim the lamps daily and another to make nightly inspections. Under the new system, the lamps were trimmed and cleaned once in two weeks. One man had ample time to take care of cleaning, trimming and repairing of lamps without the aid of the horse and wagon. and the night inspector was given other duties.

The new schedule of maintenance was changed to \$70 per arc lamp per year, and \$22 per 100-watt tungsten per lamp per year.

Proper attention was also called and allowance was made for items such as cleaning, outage, replacements, renewals, changes, additions, etc.

The distribution curves of the units selected under the new contract are shown in Diagrams Nos. 4, 5 and 6. In order to demonstrate the superiority of the new system over the old, the illumination values were secured in the same locations for both systems and will be seen in Diagram No. 3.

It will also be seen that with the new system, the changes in illumination over short distances in the immediate vicinity of the lamp are more gradual, thus giving a well illuminated area without the objectionable shadow immediately under the

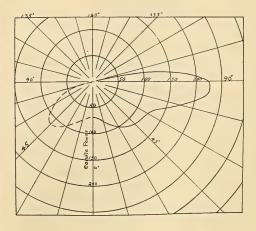


FIG. 5.

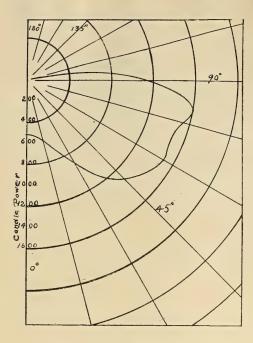


FIG 6.

lamp. As the purpose of street illumination is the discernment of objects and irregularities in the street surface, the more gradual the change the less chance is there for shadows to be mistaken for objects or irregularities.

Under the new system, no great change may be noticed in the immediate vicinity of the arc lamps, but on the other hand, a noticeable increase is affected in localities midway between lamps. This may be explained by the change in character of the magnitite arc distribution as compared with the open arc distribution, the maximum candle-power in the former case being in the region of ten degrees below the horizontal, while in the latter the maximum flux density was in the region of

forty-five degrees below the horizontal. The illumination data (Diagram No. 3) shows under the old conditions in outlying districts where open arc lamps were in use, a total abseuce of light in some portions of the street area, while in the case of the parabolic reflector and 100-watt lamps, focusing the maximum intensity at five degrees below the horizontal, a fair degree at even minimum illumination on the street surface is shown. This is partly accounted for by the decreased distance between lamps. Further, the candle-power at five degrees below horizontal with this equipment is 12 per cent. greater than in the case of the 360-watt open arc lamp. With the parabolic reflector, all the light which would otherwise be lost above the horizontal is now collected and thrown in the desired direction, not only increasing the candle-power in the axes of the reflector but utilizing the illumination ordinarily wasted upon the buildings. This is of no small consequence on residence streets as the glaring and objectionable light sources are not perceptible from the porches.

The conclusions reached as a result of this investigation were: (1) That it is poor economy to operate antiquated open arc lamps of even relatively high efficiency for street lighting in the face of high maintenance cost. (2) That the location and mounting heights of the units is of prime importance. (3) That upon the control of the light flux may depend the success or failure of the system. That an explicit contract of at least five years' duration is quite necessary. That more and better illumination can frequently be secured for the same cost by a careful investigation of local conditions and the installation of modern equipment.

"Cat's-Eye" Lights for Crossing Gates

"Cat's-eye" lamps, so called because they are not luminous in themselves, but become luminous through borrowed light, are being used in France on railway crossing gates. Each gate has three red bull'seye lenses backed by silver reflectors mounted in diamond-shaped frames. When an automobile approaches the barred crossing the light given out by the machine's lamps is vividly reflected by the "cat's-eye" lamps, giving warning of the presence of the gate.

AMERICAN ELECTRIC SIGNS IN URUGUAY



BY DAVIS H. TUCK

For several years small electric street signs of American makes have been used in Uruguay, all of which gave only reading. On January 20, 1912 the first large electric changing display sign was opened for service with a capacity for forty advertisements, each visible for seven minutes. It was manufactured in New Jersey at a cost, delivered in Montevideo, of \$3,100 with a further cost of \$3,000 for placing in position. The annual operating expenses will aggregate \$7,000. The sign is patronized by many of the local houses

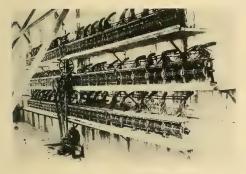


FIG. I.—INTERIOR OF SIGN, SHOWING REVOLVING CONTACTS.

and newspapers and by industries from other countries. It is situated at the western side of the Plaza Independencia, through which pass thousands of people during the day and night, doubtless the best site in Montevideo. It is operated by Publicidad, a well organized advertising concern in Uruguay, which also places advertisements in the various newspapers, periodicals, street cars, and bill boards throughout the Republic, also supplying free of cost, information relative to where advertising should be placed to produce the best results.



FIG. 2.—INTERIOR OF SIGN, SHOWING THE DRIV-ING MOTOR AND THE WIRING CONSTRUCTION

This sign is the property of a young Uruguayan, who spent two years in the United States making studies of the best American novelties to introduce into his native country. This venture has succeeded so well that he is now planning to erect similar signs, but of greater capacity, in the cities of Buenos Aires and Rosario (Argentina), Rio de Janeiro and Sao Paulo (Brazil), and Santiago and Valparaiso (Chile).



FIG. 3.—DISPLAY SIGN AS SEEN FROM THE PLAZA INDEPENDENCIA.

TECHNICAL

ABSTRACT OF REPORT OF COMMITTEE ON NOMEN~ CLATURE AND STANDARDS OF THE ILLUMINATING ENGINEERING · SOCIETY

Proposed Definitions.

Your committee has held many meetings during the past year for the consideration of definitions of photometric quantities and begs to submit the following list tentatively adopted:

Luminous $flux^1$ (light) is the physical stimulus produced by radiation, which ex-

cites vision.

The stimulus co-efficient Kx for radiation of a particular wave-length is the ratio of the luminous flux to the radiant

power producing it.

The mean value of the stimulus coefficient, Km, over any range of wavelengths, or for the whole visible spectrum of any source, is the ratio of the total luminous flux (in lumens) to the total radiant power (in ergs per second, but more commonly in watts).

The luminous intensity of a point source of light is the solid angular density of the luminous flux emitted by the source in the direction considered; or it is the flux per unit solid angle from that

source.

Defining equation:

Let I be the intensity, F the flux, and ω the solid angle.

Then I
$$=$$
 $\frac{d\mathbf{F}}{d\omega}$ or, if the intensity is uniform,

$$I = F_{\omega}$$

Illumination on a surface is the luminous flux-density over that surface, or the flux per unit of intercepting area.

Defining equation:

Let E be the illumination and S the area of the intercepting surface.

Then
$$E = \frac{dF}{dS}$$
 or, when uniform, $E = -\frac{F}{S}$.

Candle,—the unit of luminous intensity maintained by the National Laboratories of France, Great Britain, and the United States.2

Candle-power, -luminous intensity expressed in candles.

Lumen,—the unit of luminous flux, equal to the flux emitted in a unit solid angle (steradian) by a point source of one candle.3

Lux,—a unit of illumination equal to one lumen per square meter. The C. G. S. unit of illumination is one lumen per square centimeter. One millilumen per square centimeter is a practical derivative of the C. G. S. unit. One foot-candle is one lumen per square foot, and is equal

energy. ² This unit, which is used also by many other countries, is frequently referred to as the international candle. ³ A uniform source of one candle emits 4 π lu-

¹ Luminous flux is proportional to the rate of flow of radiant energy and to a stimulus coefficient which depends chiefly on the spectral distribution of that

to 1.0764 millilumens per square centime-

Specific luminous intensity e of an element of a surface, is the ration of the luminous intensity of the element taken normally, to the area of the element, and is expressed in candles per square centime-

Defining equation:

$$\mathrm{E}=rac{d\mathrm{I}}{d\mathrm{S}}$$
, or, when uniform, $\mathrm{E}=-rac{\mathrm{I}_{\bullet}}{\mathrm{S}}$.

Brightness b or apparent specific intensity of an element of a luminous surface from a given position, is the luminous intensity per unit area of the surface projected on a plane perpendicular to the line of light, and including only a surface of dimensions small in comparison with the distance to the observer. It is measured in candles per square centimeter of the projected area.4

Defining equation:

Let θ be the angle between the normal to the surface and the line of sight.

Then

$$b = \frac{d\mathbf{I}}{dS \cos \theta}.$$

Specific luminous radiation,—the luminous flux-density emitted by a surface, or the flux emitted per unit of emissive area. It is expressed in lumens per square centimeter.

Defining equation:

Let E' be the specific luminous radia-

Then, for surfaces obeying the cosine law of emission.

$$E'=\pi_e$$
.

Coefficient of specular reflection,-the ratio of the total luminous flux emitted by a specular or truly reflecting surface to the total luminous flux incident upon it. It is a simple numeric.

Coefficient of diffuse reflection,—the ratio of the total flux emitted by a diffusive surface to the total flux incident upon it. It is a simple numeric.

Defining equation:

Let m be the co-efficient of reflection (specular or diffuse).

Then

$$m = \frac{E'}{E}$$

Fundamental luminous standard,—a recognized standard of luminous intensity reproducible from specifications.

Primary luminous standard,—a standard of luminous intensity to which secondary standards are referred for calibration, and by means of which the unit of candle-power is maintained.5

Secondary luminous standard, — a standard derived or evaluated by comparison with a primary luminous standard, and used as a reference or as a working standard.

Reference standard,—a photometric standard⁶ preserved for reference and used in standardizing working standards.

Working standard,—any standardized luminous source for daily use in photom-

Comparison lamp,—a lamp of constant but not necessarily known candle-power against which a working standard and test lamps are successively compared in a photometer.

Test lamp, in a photometer,—a lamp to be tested.

Performance curve,—a curve representing the behavior of a lamp in any particular (candle-power, consumption, etc.) at different periods during its life.

Characteristic curve,—a curve expressing a relation between two variable properties of a luminous source, as candlepower and volts, candle-power and rate of fuel consumption,7 etc.

Mean horizontal candle-power of a lamp,—the average candle-power in the

⁴ It is to be noted that in practical photometry it is the apparent specific intensity of a luminous surface or element thereof which is observed, and not the specific intensity e.

For surfaces for which the cosine law of emission holds, the quantities e and b are equal.

f It is desirable that the primary luminous standard should be a fundamental luminous standard as above defined, but if the precision with which the fundamental standard can be reproduced is insufficient, the primary standard may have to be constituted in some other manner, as, for example, by a group of seasoned incandescent electric lamps in which the mean value of the group, originally derived from some fundamental standard, is assumed to remain constant, and is used to maintain the value of the unit. Thus, the Hefner lamp is in Germany both the fundamental and the primary standard, whereas in America it is a fundamental standard, but not the primary standard.

§ It may be either a primary or a secondary standard according to circumstances.

† Curves expressing the behavior with respect to time of life are here excluded, being considered as performance curves.

performance curves.

horizontal plane passing through the

luminous center of the lamp.

It is here assumed that the lamp (or other light-source) is mounted in the usual manner, or, as in the case of an incandescent lamp, with its axis of symmetry vertical.

Mean spherical candle-power of a lamp,—the average candle-power of a lamp in all directions in space. It is equal to the total luminous flux of the

lamp in lumens divided by 4^{π} .

Mean hemispherical candle-power of a lamp (upper or lower),—the average candle-power of a lamp in the hemisphere considered. It is equal to the total luminous flux emitted by the lamp in that hemisphere divided by 2^{π} .

Mean zonal candle-power of a lamp, the average candle-power of a lamp over the given zone. It is equal to the total luminous flux emitted by the lamp in that zone divided by the solid angle of the

zone.

Spherical reduction factor of a lamp, the ratio of the mean spherical to the mean horizontal candle-power of the lamp.8

It should be understood that the definitions given above are subject to revision. Indeed, on some points the committee itself is not entirely agreed. The committee will, therefore, be very glad to receive written communications criticising these definitions and making suggestions of other quantities to be defined with suitable definitions for them.

As has already been stated, it is hoped that there may soon be held an international conference on these questions over which there is not general agreement. In order to lead up to international agreement, this committee believes that it will be doing good service in presenting this national report in advance, hoping that similar reports may be proposed shortly by other national photometric societies or committees. When such national reports may have been formulated and circulated, the task before the international convention will doubtless be greatly simplified.

The American members of the committee desire to particularly express their indebtedness to their distinguished French colleague, M. Blondel, who, in spite of the limitations of distance, has rendered such excellent service to the committee, as he has, indeed, to the whole science in which we are engaged.

Respectfully submitted, for the com-

mittee,

A. E. KENNELLY, Chairman.

C. H. SHARP, Secretary.

"BLUE" GAS

By Dr. Robert Grimshaw

At first when the invention of Herr Blau was brought to public attention in German-speaking countries, it was called simply "Blau gas;" and in translating this term the fact was lost sight of that the gas itself was not blue, but that the name of the inventor may be so translated, and the name "blue" has stuck to the gas. (On the same principle of translation, the gas made according to the patents of the late Dr. Mond should be translated and known as "moon gas.")

Be that as it may, the "Blau" or "Blue" gas is coming to the fore in Germany and other countries where the idea is getting introduced that it is possible to have local gas lighting without being in the neighborhood of a gas works.

In an interesting paper by Dr. A. Neuburger of Berlin in "Licht und Lampe," he considers the question of the introduction of the Blau gas for lighting villas, small towns, large halls, etc., by liquid gas, and not only this, he calls public at-

 $^{^8}$ In the case of a uniform point-source, this factor would be unity, and for a thin cylindrical filament obeying the cosine law it would be $\pi/_4\cdot$

tention to the fact that by the use of compressed Blau gas motors may be driven, riveting and welding operations performed, etc.

As champion of the compressed gas Dr. Neuburger makes out his case quite well. Of course the recent declaring of many of the Pintzsch patents to be open to public use has had much to do with the increased activity on the part of the advocates and manufacturers of other species of gas.

The idea of compressing ordinary illuminating gas at the works where it is manufactured had of course been tried many, many times; but there had been but little success until Blau managed to do it with his new product. The former difficulty having been that under compression the ordinary illuminating gas has usually showed a tendency to stratify or separate. This might be expected from a fluid which not only is composed of several different sorts of hydrocarbons but also contains carbonic oxide and other compounds. Its use had been limited to lighting railway cars and marine buoys, and similar purposes. The idea of Blau, who is a chemist and engineer located in Augsburg, consists in making the gas from mineral oils by dry distillation, as is the case with coal gas. The gas which he obtains by this dry distillation has the advantage of being not only perfectly homogeneous but also water-white, and that it is entirely free from carbonic oxide (CO) which latter is poisonous, and all the more dangerous because colorless and free from odor.

The following table is given by Neuburger as fairly representing the average heating and lighting powers of the various sorts of gas mentioned.

From these figures one can see that the Blau gas, not only in the matter of heating power but also in illuminating qualities, is superior to the ordinary varieties used for the same purposes. Now when to this fact there is considered the advantage of compressibility, we see that the new illuminant is entitled to our consideration. It may be compressed to one-four-hundredth of its volume as manufactured.

As now on the market in Germany, the smallest flash contains 0.49 liter or 0.167 cubic feet, and weighs 0.25 kilograms or 0.55 lbs. avoirdupois. The largest flask which is adapted for transportation contains 49 liters, weighing 25 kilograms. In both cases the pressure is 100 atmospheres, or about 142 lbs. per square inch. The amount of gas in the large flask is sufficient to run a flame of 50 standard Herzner candles in an incandescent burner 1238 hours, or four hours per day for 310 days. This being the case, it is easy to see that in a small installation a few flasks may readily be made to serve for a year. In using the compressed Blau gas, says Dr. Neuburger, it is only necessary to fill the gasometer (falsely so-called) from time to time therewith by opening the cock between the flask and the gasometer. (The translator sees no reason why an ordinary reducing-valve could not be employed, to save this trouble.)

Kind of gas.	Heating power in calories.
Air gas	2,900 per cu.m.
Coal gas	5,000
Acetylene	17,000
Blaugas I	15,349
Blaugas II	12,318 per kg.

Lighting power in Herzner candles.

500 Incandescent burners

1,666 Slit burner
3,000
2,400 Incandescent



EDITORIAL

CRITICISM

Criticism may be constructive or destructive, or a combination of the two. Then, again, there is the characterless attitude which, through either fear or ignorance, fails to criticise.

We are now passing through a most critical period as regards the whole subject of lighting. Changes are appearing with startling rapidity. In fact, developments have arrived more rapidly than their significance could be assimilated and related.

If the subject of light was solely a physiological, a sociological, a psychological, an aesthetic, an engineering, etc., problem, its simplification would be a comparatively easy matter.

Inasmuch, however, as the correct interpretation of the subject necessitates the recognition of many varied lines, the solution of the problem becomes extremely complex and difficult.

Up unto the present time, there has been a decided tendency for those interested, particularly in some special phase of the work, to rather underestimate the importance of other closely allied features, with the result that a great deal of criticism has not, through lack of constructive effort, advanced the subject of light as a whole.

In order that just, intelligent, constructive criticism may be effected, it becomes necessary for the critic to have a broad, deep knowledge of the subject in its entirety, and at once a wholesome respect for each of the numerous phases entering thereinto.

The present Editor of GOOD LIGHTING has for a long time past been conducting an analytical, searching investigation of lighting conditions with the object in view of co-ordinating the subject through the medium of an effective magazine.

GOOD LIGHTING assumes the role of the progressive. It intends to present, as forcibly as possible, conditions as they exist; also the remedies, the intention being to establish realistic ideals.

Such development naturally involves criticisms which not always will, by all, be well received.

However, it is the majority, representing broad, practical conditions, whom we will serve.

Criticisms in GOOD LIGHTING will be expressed without fear, favor, or prejudice, and they will generally be definite—not beating about the bush—so that the lighting public may readily understand our attitude.

The columns of GOOD LIGHTING are open to anyone, should he agree or disagree with us; also for bringing to the attention of the lighting world meritorious developments, with the understanding, however, that the text in GOOD LIGHTING must be absolutely free of commercialism, for GOOD LIGHTING is independent to the full meaning of the word, and cannot be considered as an "associated catalogue."

FACTORY LIGHTING

The subject of factory and workship lighting is one of the most important phases of illuminating work—especially so from the hygienic, sociological, as well as economic points.

It is a problem which should be approached with considerable respect,—and the solution involves the exercisement of varied and extended knowledge of light and its effects.

The simple introduction of ordinary foot-candle calculations gives no assurance of the attainment of thoroughly satisfactory conditions.

While some effort has been made to better conditions—chiefly through the office of the manufacturer, for which work we should be duly appreciative—yet there has been no organized activity—individually or collectively—to create practical working standards which might be accepted as realistic ideals.

While our knowledge of light is by no means complete—in fact it might almost be considered embryonic—yet we are qualified to indicate applications of light which would represent very considerable improvement over that which we now encounter on every hand.

Those who have been in a position to further such movement have apparently lacked the incentive, for while much improvement in this class of work has been effected, yet the great vastness and importance of the work has seemingly been considerably underestimated.

The present Editor of GOOD LIGHTING, alive to the situation and

possibilities, will urge—in every way possible—the due recognition of this phase of lighting; and the columns of GOOD LIGHTING will be used to influence the introduction of commendable methods and equipment.

An excellent way in which to inaugurate such a campaign is to reproduce, in part, the unusually meritorious 1911 report of Mr. D. R. Wilson—his Majesty's Chief Inspector of Factories and Workshops—of London, England, which is noted elsewhere in this issue of GOOD LIGHTING.

This report is without precedent.

It treats with the subject of light, as applied to factory conditions, in an intelligent, energetic manner indicative of enthusiasm, coupled with an appreciation for the great importance of the work. Inasmuch as the report is official, its contents will have considerable bearing, not only in influencing the public, but influencing legislation as well.

Without in any way detracting from the most commendable work of Mr. Wilson, we can, in all propriety, indicate our appreciation for the splendid work conducted by the Illuminating Engineering Society of England, whose persistent, forcible, and logical spreading of the gospel of light has caused the subject to be the more respected and considered by those individuals and legislative bodies whose operations influence mankind.

May the good work keep up!

A CORRECTION

An impression has gained some headway to the effect that the present Editor of GOOD LIGHTING is giving his *entire* time to editing this magazine. Such idea is erroneous.

The fact is that GOOD LIGHTING is receiving but a part of his time, and that his major time, with that of his partner, F. Laurent Godinez, is being used in the interests of Central Stations, Gas Companies, Architects, Fixture Concerns, the public, etc., as consulting and designing lighting specialists.

WINDOW LIGHTING

The lighting of a show window. How easy! Conceal lights from view of street; direct rays upon goods displayed. There you are. How very simple!

'Tis said "Familiarity breeds contempt"; it might be said that absence of thought or the lack of realization of needs attending a condition assures poor results.

An excellent opportunity to observe evidences of lack of analytical, constructive thought may be noted on every hand in the lighting of show windows.

Take a walk down most any street in the evening when the windows are "lighted." You will see—when you, through voluntary effort, endeavor to observe—a number of windows, in general alike in so far as lighting effects are concerned, their differences lying usually in various characters of displays as regards merchandise and its arrangement.

Now suppose that these *motionless*—not different displays—came to "life." Suppose that more or less kaleidoscopic changes would be systematically effected much as scenery is changed, or color and other effects are produced on the stage?

Your attention would be *involuntarily* arrested. Your curiosity would be appealed to. You would seek information.

That's advertising!

That is what display windows are for.

Effects produced may be spectacular—"loud," dignified—"quiet," or otherwise, as conditions may warrant. Effects obtainable are only limited by the ability of the designer.

Here lies a tremendously large field that can easily be developed to the profit of the Merchants, Central Stations, and Gas Companies, the Manufacturer of equipment, and the pleasure of the buying public.

Think it over,—then act!

ILLUMINATING ENGINEERING SOCIETY

In last month's issue of GOOD LIGHTING appeared a review of the programme of the Sixth Annual Convention, Illuminating Engineering Society.

This month we desire to make some editorial comments.

The Convention this year was the most successful the Society has ever held. This was due largely to the class of papers presented, but more especially to the rather unexpected form of discussion which developed therefrom.

This year there was greater evidence of an appreciation for the effect of light from the physiological, psychological, aesthetic, and practical viewpoints, and an unorganized tendency to subordinate the strictly engineering phase to its more nearly correct relative position.

That such was the development was no fault of the Society, for the Society—or those who control its efforts—has, from its inception, given greater weight to those less important factors that sooner or later must recognize their peers.

It is the same old story—a good factor cannot be kept permanently down. Right will right, and the sooner the Illuminating Engineering Society realizes that its narrow, biased interpretation of the great subject of light, both natural and artificial, is not giving the impetus to the movement that otherwise would be the case, the better off the Society and the public will be.

As far as the subject of light is concerned, it cannot be killed—though its progress may be retarded.

The subject of light is too great to be constantly adjusted and confined to suit the whims of a few. Ere long a proper guardian will be developed—or created—and then the great possibilities of light will receive more extended, logical considerations.

Light is a most willing servant, and, if properly handled, a mighty good one.

Artificial light may be employed as a great power for good,—used to overcome darkness, giving greater latitude to activities, and the creation of pleasing conditions for recreation.

Light—or, more correctly stated, its ill-use—may be a curse.

Many—yes, innumerable—places of work use light so poorly that the eyes of the operators are sorely taxed, if not ruined.

It would appear that the greatest field of endeavor of a body organized to consider lighting would be to correct such harmful conditions, and cause mankind to appreciate his greatest organ of sense—the eye—rather than splitting hairs over lumens per watt efficiencies, and constantly considering more or less unimportant glassware and kindred subjects.

Legislation could—with the right sort of effort—be influenced,—it is being done in England—and lighting conditions vastly improved.

Such development would represent real advancement.

Many are the other important phases a Society, properly conducted, could further. They will be referred to from time to time.

But, of course, such extended, constructive work demands the efforts of broad gauged persons representing, and truly interested, in all phases of the work.

Perhaps, in time, a larger number of such persons might find it agreeable to work through the Illuminating Engineering Society—or may be another body will rise and the more adequately administer to the work.

The Illuminating Engineering Society is weak—far weaker than some of its constituents realize. Golden opportunities are being offered on every hand to assure its strength.

May the Society become alive to its position, and then, through properly organized work, realize them.

These comments are made with full recognition and appreciation for the most worthy pioneer efforts and attainments of the Illuminating Engineering Society.

The subject of light is *now*, however, advancing more rapidly than the attitude of the Society.

Such should not be the case.

"Breadth!"

STORE LIGHTING

It would seem that we might, in the not far distant future, be relieved of the non-productive, depressing, monotonous lighting conditions which prevail, especially in what might be termed the small store class.

Until quite recently, the lighting of this class of stores has been principally determined by set illumination formula, with comparatively little or no respect for the personality of the proprietor; the general class, character, and arrangement of the store; or its relation to other stores of a more or less competitive nature.

There is now reason to feel that ere long, at least in some communities, lighting installations for stores will be actuated by some degree of consistency—in other words, the lighting of a drug store will be dissimiliar to that of a grocery store, and the lighting equipment of a millinery establishment will not be a reproduction of that used in a delicatessen shop,—conditions which prevail at this time.

The Central Stations and Gas Companies are beginning to realize that monotony in lighting design is not productive of increased revenue. In fact, they now realize that too much uniformity in lighting design tends to place lighting in the class of a necessary evil. But that the judicious use of light gives rise to expression which is at once satisfying to the consumer, pleasing to the public, and, through its individuality of treatment, of considerable advertising value, and, incidentally, productive of greater financial returns.

There are some Public Utilities that are now providing educational work of a highly original character for their employees, which work has as its object the arousement and stimulation of the imagination, which, coupled with an appreciation of practical requirements; the respect for the aims of the proprietors; and a knowledge of physical factors involved, will enable the representatives of Central Stations and Gas Companies to, with little effort and expense, create conditions which will be agreeable to all concerned.

This educational work is vastly different from anything heretofore attempted. It is not tendered by any manufacturing interests, but by competent practising authorities who are alive to the needs of the Public Utilities and the public.

The day of the operator who relies solely, or even principally, on lumen-per-watt factors in designing lighting installations is fast waning. May its speed of departure ever increase.

We are on the threshold of a new era in lighting and changes for the better, even in commonplace establishments, will shortly be manifested.

The exercisement of imagination and co-ordinated thought, rather than slide rules, will effect these desirable—nay, necessary—changes.

OUTLINE LIGHTING

The use of light to outline buildings, and other objects, has received some attention, but nowhere near the thought that conditions warrant.

In some instances small (usually 4 c. p. to 16 c. p.) incandescent electric lamps have been employed in forming prominent horizontal and vertical lines, the lamps being placed a few inches apart.

In some few cases the illuminants have been utilized to create an effect removed from the purely "mechanical" by treating and arranging the lamps so that the principal architectural lines would be accentuated without casting the rest of the building into oblivion.

In most cases the results have left much to be desired; first, the high intrinsic brilliancies of untreated lamps (clear—not frosted) have had a blinding effect, causing other parts of the building to be disproportionately considered.

Secondly, the general arrangement of lamps, usually in inartistic lines, have distorted rather than enhanced the general effect.

Third, while the broken effect (a lamp placed every few inches with less bright space intervening) is desirable for some classes of service, yet there are conditions that would seem to require a continuous—unbroken—line.

There seems to here be an opportunity for the use of long tube lighting, the light of which being radiated with a low order of brilliancy, so that principal architectural lines may be accentuated softly, yet definitely.

We have here a great field—almost a virgin one—to develop. Many buildings should be equipped for effective outline lighting during their course of construction, thus saving the intermittent temporary effects created for various celebrations. Buildings now erected, where such lighting would be desirable, could provide for such treatment at no considerable expense.

The "City Beautiful" plans, under course of development by many cities, would be considerably augmented by employing lights

in such manner.

SOCIETIES

The Illuminating Engineering Society, with headquarters in the United Engineering Societies building, 29 West 39th Street, New York City, has Sections in the following Cities: Boston, Philadelphia, Pittsburgh, Chicago, and New York.

It is customary that in each of these Sections monthly meetings be held, at which time papers dealing with various phases of light are read and discussed. Each of the Sections endeavor to prepare—in advance as far as possible—a programme for the season's activity.

Following is published the tentative programmes of the Pittsburgh and New York Sections: Programmes dealing with activities in other sections will be pub-

lished as soon as received in this office.

PITTSBURGH SECTION.

November.

"The Use of Lenses in Illumination."
By Prof. H. S. Hower.

December.

"Store Illumination."

January.

"Street Lighting." By C. E. Stephens. February.

"Gas Illumination."

March.

"The Incandescent Lamp in the Central Station Business."

April.

"Some Phases of Railroad Illumination."
By J. L. Minick.

May.

"Physiological Aspects of Illumination."

A joint meeting has been arranged with the Local Section of the American Institute of Electrical Engineers. The probable programme for this meeting will be the paper on "Street Lighting," by C. E. Stephens.

Lectures on the elementary phase of the subject of lighting by Prof. H. S. Hower are planned for. The time consumed by these lectures will be approximately fifteen to twenty minutes, same to precede the regular meeting.

NEW YORK SECTION.

November 14.

Joint meeting with the National Electric Light Association. Subject:—Demonstrations of Lighting Effects, by Preston S. Miller.

December 12.

Joint meeting with the Committee on Prevention of Blindness of the New York Association for the Blind.

January 9.

Joint meeting with the National Commercial Gas Association.

February 13.

Joint meeting with Municipal Art Society.

March 13.

Joint meeting with the American Institute of Mechanical Engineers.

April 10.

Joint meeting with the American Institute of Architects.

May 8.

Joint meeting with the American Institute of Electrical Engineers.

IN the August, nineteen hundred twelve, issue of GOOD LIGHTING, on page 290, appeared the following: "It is the *future* issues of GOOD LIGHTING that will express our conceptions and warrant your pleasure. The present issue, the starter, is but the result of a hasty effort."

The September issue of GOOD LIGHTING, while far from being representative of the ideals which we have erected and which each succeeding issue will the more closely approach, is a long step in advance of anything heretofore accomplished, of a similar nature.

The current—October—issue, in development, is about to September as September was to the August issue. It will be noted that the character and complexion of GOOD LIGHTING has undergone sweeping, extensive changes—all of which have been for the better.

The present—entirely new—management of Good Lighting have in course of progress a treatment of the subject of light (natural and artificial)—in all of its numerous phases—which will largely represent absolutely original ideas and development—such expression placing the tremendously important subject of light on the lofty pinnacle of esteem and greatness it should, by its very nature, occupy.

THE EDITOR.

PUBLICATIONS

Light, Photometry and Illumination

By WILLIAM EDWARDS BARROWS, JR., B.S.E.E.

Professor of Electrical Engineering, University of Maine.

The above is the title of a book recently published by the McGraw-Hill Book Company of New York, designed as a text in "illuminating engineering" and a reference for the practising engineer. It is stated that the volume is the outgrowth of sets of notes written and compiled by the author for use in his classes at the Armour Institute of Technology, and his previous book "Electrical Illuminating

Engineering."

The author states that in the construction of this volume he has freely consulted volumes of the technical press and particularly the Transactions of the Illuminating Engineering Society, the Illuminating Engineer, now Good Lighting, the Bulletin of the Bureau of Standards, and the Electrical Word. It has been his aim to assemble the best ideas and facts available on the subject of artificial illumination, and in doing so has freely drawn from the works of eminent authorities on particular phases of this subject, naming Dr. H. E. Ives, Dr. A. S. McAllister, Dr. E. B. Rosa, Mr. M. D. Cooper, Mr. A. J. Sweet, Mr. A. A. Wohlauer, and others, "whose excellent papers and kind permission to use them are gratefully appreciated." The author indicates his appreciation of criticisms and suggestions by Dr. H. E. Ives, and the kindness of F. H. Bernhard in reading proof and criticizing copy, also the efforts of the publishers in editing his book.

The book is written in twelve chapters, namely, Light and its Physical Properties; Color Values of Illuminants and Color Effects; The Luminous Equivalent of Radiation; Standards of Luminous Intensity; Photometric Units and Nomenclature; The Principles of Photometry and

Types of Photometers; Portable Photometers and Apparatus for Obtaining the Distribution of Light from a Source; Light-flux Calculations and Spherical Photometry; Illumination Calculations—Point Source; Photometrical and Illumination Calculations—Surface Source; The Principles of Interior Illumination; The Principles of Street Illumination.

Each of the foregoing twelve chapters are sub-divided into a number of divisions, each of which treat with some particular

phase of the general subject.

As stated in the author's preface, the present volume is largely an elaboration on the author's previous effort "Electrical Illuminating Engineering," with the liberal use of matter presented in articles before the Illuminating Engineering So-

ciety or through the press.

The book, as a whole, is one which will find greater favor with the technically inclined man—the engineer—than the practical man who is seeking working data to apply to every day problems. The book should also be of particular value to college students of light, especially if the information contained can be explained and practically demonstrated by a competent authority.

The first chapter, namely, Light and its Physical Properties, carries a number of tables which would be the more valuable if properly qualified and more extensive-

ly explained.

The various chapters devoted to the subject of photometry contain much matter that is of interest, though of a nature probably confined to the use of the scientist and the student, for which, probably, the book has been developed.

The chapters on Illumination Calcula-

tions treats with matter which has been pretty generally discussed, and, as far as the writer is able to ascertain, no expression is made by the author of this book as to which of the several methods discussed are the best for particular classes of work, which absence of constructive suggestion might lead to confusion on the part of the uninitiated. Here again in these chapters, where use is made of tables suggestive of factors or quantities, there is a notable absence of qualifying restrictions which should accompany such tables were used.

In the last two chapters of this book Mr. Barrows attempts to outline principles involved in interior and exterior illumination. Mr. Barrows has attempted to accomplish in approximately seventy pages what would be exceedingly difficult to express in seven hundred pages, with a consequent lack of breadth. These two chapters on interior and exterior lighting would seem to have been written by Mr. A. J. Sweet, or else the matter very freely borrowed from Mr. Sweet's writings. Further comment on these two chapters is perhaps unnecessary.

The Aldrich Plan in the Light of Modern Banking

By LUDWIG BENDIX.

This book of 240 pp., price \$2, net, postage 14c., published by Robert R. Johnston, New York, treats with the text of the bill proposed by the Monetary Commission. This bill is fully analyzed, and its significance to American business men is discussed in detail.

The ends sought in the proposed currency reforms are summed up in the following quotation, as also the essential features in the measure urged under the name of the Aldrich Plan:

"The purpose of reorganizing the existing monetary and credit system is, in the first place, to insure greater security in crises, and to create some measure of protection against the outbreak of panics. At the same time, the aim is to strengthen the credit basis on which the business of the country rests, and to bring about a better and more equitable utilization of our financial resources, in the interest of all sections of the country and of all

branches of our industrial activity. The plan of reform proposed by the Monetary Commission is based on the fundamental belief that, to achieve these ends, the cash reserve of the country must be concentrated in some central agency, that our system of issuing notes must be reorganized, and a market developed for short time loans and discounts. To carry into effect these reforms, the plan proposes the creation of a new type of institution, authorized to issue circulating notes, and charged with the keeping of the gold and cash reserves of the country. The institution advocated, the National Reserve Association, is to be essentially a cooperative union of the existing commercial banks, the vital elements in the present credit system. To the Association are assigned certain functions, enabling it to carry out the general purpose of the plan, and in itself it is to form the keystone in the reorganized system."

PRESS REVIEW

The changes already effected—in the very short period of time by the new management—in Good Lighting are sweeping and extensive. Even as extensive as the improvements have been, they can be but considered as indicative of what is to follow.

Naturally, everything could not be tackled and brought up to *our* standard at once—the job is a big one. One of the Departments that has received considerable *thought*, and *its programme arranged for*, is that of the Press Review.

The Review of the Press, which will appear shortly in Good Lighting, will be a review in every sense of the word. This Department, as we will conduct it, will be of great value to the lighting world.

We appreciate your consideration.

GOOD LIGHTING And the Illuminating Engineer

H.A.Buck Bus. Mgr. Robert R. Johnston Adv. Mgr.

VolumeVII

Nov. 1919.

Number 9

OUR CREED

Be it understood that GOOD LIGHTING—in its present form—does not attempt to primarily reflect "illuminating engineering" in its narrow physical and commercial senses.

GOOD LIGHTING appreciates the fact that *numerous important* phases are involved in the use of light—natural and artificial.

It will be the policy and object of GOOD LIGHTING to accord to all aspects of the subject full respect and consideration—also due recognition of related values.

Albert Jackson Marshall Editor



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MOONLIGHT AT NIAGARA FALLS

RECARDING PROPOSED LECISLATION & LIGHT-ING STANDARDS FOR FACTORIES

Probably the most important work confronting the lighting world is that of establishing lighting conditions in factories, workshops, offices, schools, etc., that will enable the millions of workers to use their eyes with the least possible strain, which development, incidentally, will assure a higher grade of work, and more profitable economic returns.

Some progressive far-reaching factory owners have been able to appreciate the value of good lighting as an all around asset, but there are numerous factories, workshops, and sweatshops that have not taken advantage of improvements in lighting and its application, who, in justice, at least, to their operators, and the public, must be guided by legislation into employing standards that are more in keeping with our advanced knowledge of light and its effect upon our being, our relation to society, and our productiveness.

The subject of factory regulation is largely a matter of State control, and it would seem that for the present the most effective work can be accomplished through co-operating with the various State commissions, so that they may be advised of the technique of the art and science, and have practical standards erected and duly inscribed on the statute books.

Good Lighting has reason to feel that very considerable advances may be promptly effected in factory lighting conditions through the co-operation of those who are, to a great or lesser degree, familiar with the subject.

Up until the present time, we have heard, on many occasions, what a difficult

task it would be to attempt such development.

Good Lighting rather relishes difficult assignments, especially if their fulfillment will help humanity and help place the great subject of light on that lofty plane it should occupy.

Herewith is published a letter from Abram I. Elkus, Chief Counsel, New York State Factory Investigating Commission, wherein assistance is frankly courted.

We also print, in full, the tentative bill alluded to in Mr. Elkus' letter.

The latter part of the proposed bill treats with lighting. It will be noted that proper and adequate light is sought. What is proper and adequate light? That's what the Commission desires to know. And that's what we of the lighting world should determine and impart.

We have often heard uncomplimentary remarks directed at the "silly" laws developed to regulate factory lighting. Such criticism has been chiefly of the destructive order, or worse.

We now seek constructive suggestions. Send them to Abram I. Elkus, New York State Factory Investigating Commission, at 170 Broadway, New York, and by such action help this great and worthy cause.

Good Lighting would have pleasure in tendering any assistance within its power to further the interests of similar Commissions in other States. The columns of Good Lighting are open to any expression which will help clarify the situation in this and other phases of light, both natural and artificial.



HON. ROBERT F WAGNER,
HON. ALFRED E. SMITC Chairman
HON. CHARLES M. HAMILTON
HON. EDWARD D. JACKSON
HON. CYRLIS W. PHILLIPS
MR. SAMUEL COMPERS
MR. SIMON BRENTANO
MR. ROBERT E. DOWLING
MISS MARY E. DREIER

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NEW YORK STATE

FACTORY INVESTIGATING COMMISSION

(Authorized by Chapter 561 of the Laws of 1911, and Chapter 21 of the Laws of 1912, to inquire into conditions generally under which manufacturing is carried on)

Office of the Commission, No. 22-East-Seventeenth-Street

Telephone 1155 Stuyvesant

New York City

DR. GEORGE M. PRICE, DIMECTOR OF INVESTIGATION

MR. FRANK A. TIERNEY, SECRETARY

MR. ABRAM I. ELKUS, Chief Counsel MR. BERNARD L. SHIENTAG, Assistant Counsel No. 170 Broadway New York City

New York, November 1, 1912.

Mr. Albert Jackson Marshall,

Editor, "Good Lighting".

15 West 38 Street, New York City.

My dear Sir:

I am sending you herewith copy of a proposed bill that the Commission has issued relating to artificial illumination in factories. This bill simply embodies recommendations that the Commission has received and has not yet been approved or adopted. We should be very glad to have you go over this bill and give us your views and suggestions concerning same at an early date. We should appreciate it also, if you would send us a list of the names and addresses of all persons who would be interested in any proposed legislation dealing with illumination in factories and we shall be very glad to send them copies of the proposed bill.

Yours very truly,

Alsay Elly

PROPOSED BILL

(This proposed bill embodies recommendations submitted to the New York State Factory Commission. It is tentative merely and has not yet been approved by the Commission and is submitted in its present form for criticism and suggestions. Please address all communications concerning this proposed bill to the New York State Factory Commission, 170 Broadway, New York City. If you desire to be heard on the proposed bill, please notify the Commission.)

AN ACT

To amend the labor law in relation to the protection of employees operating machinery, dust creating machinery, and the lighting of factories and workrooms.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section I. Section eighty-one of chapter thirty-six of the laws of nineteen hundred and nine, entitled "An act relating to labor, constituting chapter thirty-one of the consolidated laws," as amended by chapter two hundred and ninety-nine of the laws of nineteen hundred and nine and chapter one hundred and six of the laws of nineteen hundred and ten, is hereby amended to read as follows:

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§ 81. Protection of employees operating machinery; creating machinery; lighting of factories and workrooms. I. The owner or person in charge of a factory where machinery is used shall provide, in the discretion of the commissioner of labor, belt shifters or other mechanical contrivances for the purpose of throwing on or off belts on pulleys. Whenever practicable, all machinery shall be provided with loose pulleys. [All vats, pans, saws, planers, cogs, gearing, belting, shafting, set-screws and machinery, of every description, shall be properly guarded.] Every dangerous part of a prime-mover whether in motion or not shall be securely safeguarded. The term "prime-mover" shall include all steam, gas, oil or other kinds of engines, and also all electrical apparatus which generates, converts, transfers or transmits power. All vats, pans and hydro-extractors wherever set so that the opening or top thereof is at a lower level than elbow of the operator or operators at work about the same shall be protected by covers which shall be maintained over the same while in use in such manner as to effectually prevent such operators or other persons falling therein or coming in contact therewith. All saws shall be provided with a proper and effective guard. All planers shall be protected by a substantial hood or covering. All cogs and gearing shall be boxed or cased either with metal or wood. All belting within seven feet of the floors shall be boxed in with wood, metal or substantial gauge wire screens. All revolving shafting within seven feet of the floors shall be protected on its exposed surface by being encased in such a manner as to effectively prevent any part of the body hair or clothing of the operators or other persons from coming in contact with such shafting. All set-screws, keys, bolts and 36 all parts projecting beyond the surface of revolving s' fting hall

be countersunk or provided with suitable covering, and machinery of every description shall be properly guarded and provided with proper safety appliances or devices. All machines, machinery, apparatus, furniture and fixtures shall be so placed and guarded in relation to one another as to be safe for all persons employed thereabouts. Whenever any danger exists which requires any special care as to the character and condition of the clothing of the persons employed thereabouts, or which requires special apparel or clothes to be worn upon the person, the advisory board pursuant to the provisions of this chapter, may make rules prescribing what shall be used or worn for the purpose of guarding against such danger and regulating the provision, maintenance and use thereof. No person shall remove or make ineffective any safeguard or safety appliance or device around or attached to machinery, vats or pans, [while the same are in use,] unless for the purpose of immediately making repairs thereto or adjust-ment thereof, [and all such safeguards so removed shall be promptly replaced] and any person who removes or makes in-effective any such safeguard, safety appliance or device for a permitted purpose shall immediately replace the same when such purpose is accomplished. It shall be the duty of the employer and of every person exercising direction and control over the person who removes such safeguard, safety appliance or device, or over any person for whose protection it is designed to see that a safeguard or safety appliance or device that has been removed is promptly and properly replaced. All fencing, safeguards, safety appliances and devices must be constantly maintained in proper condition. [if] When in the opinion of the commissioner of labor a machine or any part thereof is in a dangerous condition or is not properly guarded or is dangerously placed, the use thereof [may] shall be prohibited by the commissioner of labor and notice to that effect shall be attached thereto. Such notice shall not be removed until the machinery is made safe and the required safeguards or safety appliances or devices are provided, and in the meantime such unsafe or dangerous machinery shall not be used. The advisory board of the department of labor may pur-suant to the provisions of this chapter, from time to time make and from time to time change or modify rules and regulations to govern the installation, position, operation, guarding and use of machines and machinery in operation in factories; the furnishing and use of safety devices and safety appliances for machines and machinery and of guards to be worn upon the person; and for any other purpose in order to provide for the prevention of accidents in factories. 2. All grinding, polishing or buffing wheels used in the course

2. All grinding, polishing or buffing wheels used in the course of the manufacture of articles of the baser metals shall be equipped with proper hoods and pipes and such pipes shall be connected to an exhaust fan of sufficient capacity and power to remove all matter thrown off such wheels in the course of their use. Such fan shall be kept running constantly while such grinding, polishing or buffing wheels are in operation; except that in the case of wet grinding it is unnecessary to comply with this provision unless required by the rules and regulations of the advisory board adopted pursuant to the provisions of this chapter. All machinery creating dust or impurities shall be equipped with

93 proper hoods and pipes and such pipes shall be connected to an 94 exhaust fan of sufficient capacity and power to remove such dust 95 or impurities; such fan shall be kept running constantly while 96 such machinery is in use; except where, in case of wood-working 97 machinery, the commissioner of labor, after first making and 98 filing in the public records of his office a written statement of 99 the reasons therefor, shall decide that it is unnecessary for the 100 health and welfare of the operatives.

3. All passageways and all moving parts of machinery where, on or about which persons work or pass or may have to work or pass in emergencies, and all other portions of a factory that the commissioner of labor may require, shall be kept properly and sufficiently lighted during working hours. When in the opinion of the commissioner of labor it is necessary, [the workrooms,] halls and stairs leading to the workrooms shall be properly and adequately lighted, and [in cities of the first class, if deemed necessary by the commissioner of labor,] a proper and adequate light shall be kept burning by the owner or lessee in the public hallways near the stairs upon the entrance door and upon the other floors on every work day in the year, from the time when the building is opened for use in the morning until the time it is closed in the evening, except at times when the influx of natural light shall make artificial light unnecessary. Such lights shall be independent of the motive power of such factory.

116 4. All workrooms shall be properly and adequately lighted during working hours. Artificial illuminants in every workroom 117 118 shall be installed, arranged and used so that the light furnished 119 will at all times be sufficient and adequate for the work carried on therein. All artificial illuminants shall be so placed and 120 121 arranged, and so shaded as to prevent strain on the vision or 122 glare in the eyes of the workers. The advisory board to the department of labor may, pursuant to the provisions of this chap-123 **I24** ter, make and from time to time change or modify rules and regulations to provide for adequate and sufficient natural and artificial lighting facilities in all factories; to govern the installation, arrangement, operation and use of artificial illuminants 125 126 127 128 in workrooms in the different industries; and to fix standards that shall prescribe the minimum amount of artificial illumina-129 130 tion in such workrooms. 131

132 § 2. This act shall take effect October first, nineteen hundred 133 and thirteen.

EXPLANATION—Matter in italics is new; matter in brackets [] is old law to be omitted.

SHOW CASE SIGNS

Among the latest store devices are small illuminated signs having ground glass slidable fronts, on which is printed information regarding the special articles for sale. The fronts may be replaced with others for the sale of

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different goods. An eight candle-power incandescent lamp is sufficient to give the necessary effect, and the design is such that they add to the attraction of the show cases on which they are usually placed.

LICHTING FIXTURES AS DECORATIVE ACCESSORIES

COURTESY THE UPHOLSTERER

From earliest times, the fear of darkness has been one of the most disagreeable obsessions of the human race, and as far back as antiquarians have been able to trace human invention of any kind, there are traces of inventions to dispel darkness.

The earliest forms of all were those that utilize conch as receptacles for oil or fat. These were followed by model clay forms, at first resembling shells, later taking other fantastic forms more or less decorative. These early forms being literally a torch with auxiliary supply, it is not surprising that the temporary torch fibers soaked in oil, resinous knots, or the dry bodies of fish were in use at the same time. Nor is it surprising that the ease with which torches could be produced contributed to their general use for thousands of years after other form of lighting exercises had come into common use.

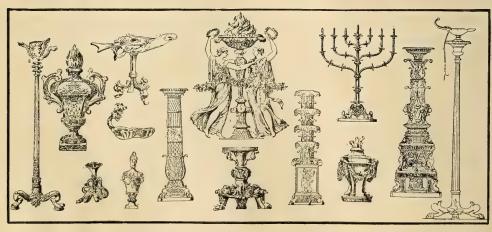
In the previous three issues of Good Lighting, we have shown interesting collection of lighting relics in possession of J. W. Johnson, Fellow of the Society of Antiquarians of Scotland, also a number of equally interesting cuts of antique and modern lighting fixtures, republished through the courtesy of the New York Edison Company.

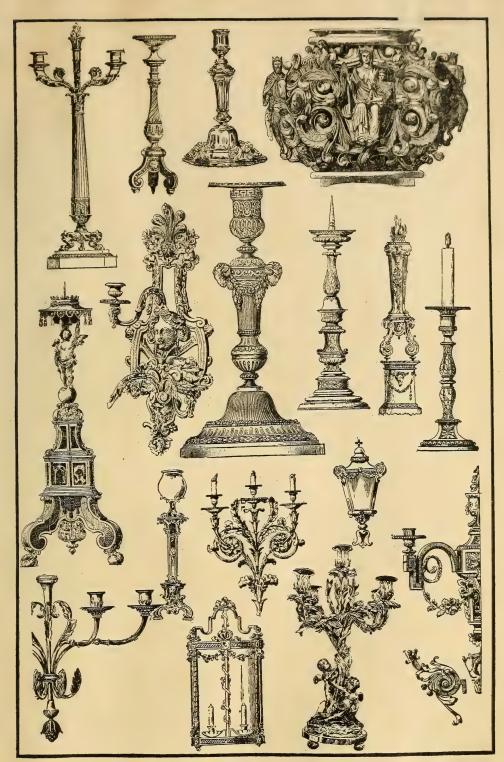
The four methods of artificial light distribution upon which the architects of the present day base their designs, viz., the portable lamp or candlestick, candelabra supported on columns or standards, chandelier suspended from ceilings and wire brackets, are founded on ideas developed in the past decades.

Of these the chandelier took early precedence, and is still the most important in the development of design and utility.

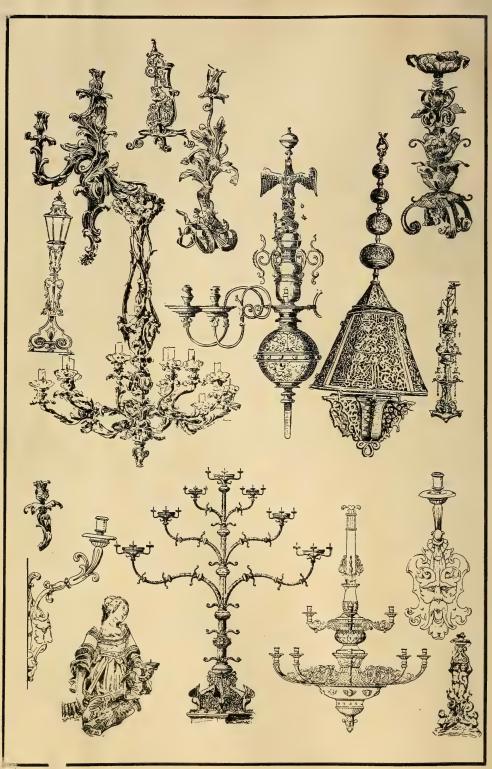
With the introduction of lighting fixtures into the decorative scheme of building interiors, this consideration became of equal importance with that of utility.

The chandelier developed in Rome, a common support for several lamps or candles, was made of bronze of elaborate and beautiful workmanship, but was used only in public buildings.

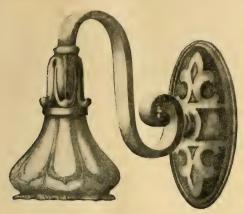




THE CANDLESTICK, SINGLE AND BRANCHED.



The wealthier classes used a single bowl with one, two or three burners, suspended from the ceiling. Additional illu-



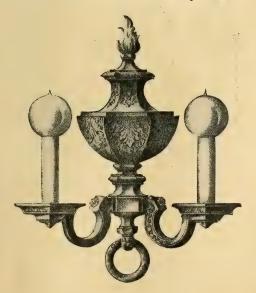
MODERN BRACKET

mination at festal occasions was provided by candelabra held in the hands of slaves.

This suspended form of support for grouped lamps developed in several parts of the world in a fresco.

In the Church of St. Lorenz, Rome, is shown a single metal ring upon which lamps were placed. It was suspended from the ceiling by three chains.

From this inspiration was probably developed the Corona chandelier, of which the most famous example is in

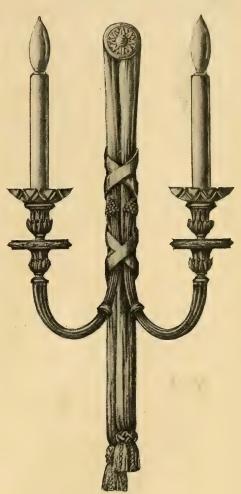


MODERN BRACKET.

the Church of St. Peter at Bastonges.

Chandeliers reached a high state of development during the period of the Crusades in the twelfth century. At that time the designs symbolized the walls and gates of the Holy City, and was confined to use in churches.

It was several centuries before lamps



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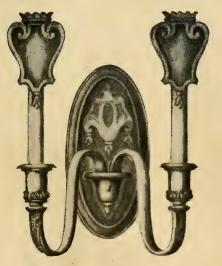
in private residences became at all elaborate. As late as the sixteenth century illustrations show domestic lighting fixtures to have been of the simplest construction. Frequently boards were crossed and lights placed on them.

The ornate entered into the construction of domestic lighting fixtures during the late fifteenth century, and there exists some beautiful examples of carved wood and wrought iron designs bearing statues of the Virgi and other religious devices.



MODERN BRACKET.

The French have always taken the lead in the design of the fixture changes, and in their treatment as part of architectural and descriptive schemes, although



MODERN BRACKET.

examples of German, Belgium and Flemish art show that the designs of these countries took an active part in their development.

During the seventeenth century art predominated in France with Lebrun, the



MODERN CHANDELIER.

master mind, and numerous fixtures of this period are treasured to-day as masterpieces. Glass was largely used as a decorative material, but not entirely to the exclusion of metal. Metal work of surprising beauty of design and workmanship still appears in museums and art collections. These fixtures were used at the time, however, only in the palaces

and chateaus of the nobility and the wealthy. Domestic lighting fixtures were still of comparatively simple construction.

Aragand invented a lamp of circular



MODERN CRYSTAL CHANDELIER.



MODERN CHANDELIER.

wick and glass chimney in 1872. was the first utilitarian improvement.

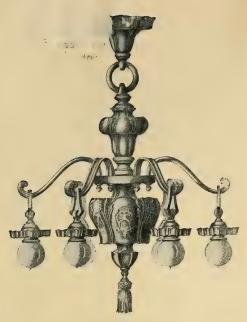
The introduction of gas in the beginning of the nineteenth century was another step toward the revolution of exte-



MODERN CHANDELIER.

rior and interior lighting. No new yr of fixtures were developed, however, sin ply an adaptation of the old chandeliers

GOOD LIGHTING



MODERN CHANDELIER.

to gas, where heretofore oil lamps had been used. The finer kinds were made



of glass tubing with cut glass ornaments, the same as the crystal fixtures of the Empire period. This was expensive, so in time cheaper material was introduced. Gas pipes of cast iron were finished by copper plate to imitate bronze.

Following this period of copper plate "Eastlake" came into vogue, both in architectural and decorative art. Fixtures made of light brass tubing with brass

stampings became popular.



MODERN CHANDELIER.

Apart from the introduction of gas fixtures, the nineteenth century contributed little in the way of change. The advent of electric light about thirty years ago opened up a new field for fixtures and design, but for a long time, following the lead of the transformation from candles and oil to gas, old fixtures formerly used for gas were adapted to the use of electricity. Chandeliers which had supported candles in the time of the Louis' and oil lamps in our grandfathers' time now held electric bulbs.

Most of the fixture designs of to-day

were in use 200 years ago, and have simply been rearranged to accommodate electric, gas, oil and candle lighting installation.

It would be unfair to deny credit to modern designers for having produced fixture designs that a e ements on the forms of ut
few real innovations ha introduced as regards arrangement of lighting
equipment design though distribution has
been greatly changed.

Note.-Modern fixture designs, courtesy Pettingell-Andrews Company, Boston, Mass.

A MERCURY-CADMIUM LAMP

Yet another attempt to improve the color of the mercury lamp is announced by Dr. M. Wolfke, who finds that he can supply the missing lines in the spectrum by the addition of cadmium. The attempt to introduce foreign metals into the mercury tube with this object has been tried before and failed. But the author states that the early difficulties have now been overcome.

The metal to be added, besides furnishing the missing red rays, should vaporize (but not necessarily melt) at a comparatively low temperature. This is essential, both with a view to high luminous efficiency and because, if the temperature of the vapour is not less than that of the tube itself, a permanent obscuring deposit will be formed. Another point to be noted is that the metal should not have any chemical affinity for quartz, otherwise the tube will be attacked.

Zinc and cadmium were selected as the most hopeful metals with which to experiment, but the former soon proved unsatisfactory. Cadmium, on the other hand, seems to possess the needed qualities. It does not attack quartz. It does, it is true, form a deposit on the tube, but this only takes place in the cold state and disappears as the tube heats up. The cadmium must, however, be absolutely pure. An addition of only 3-10 per cent of mercury, according to the size of the lamp, is necessary. The wave-lengths present are as follows:

Metal.	Wave-length.	Color.
Mercury	$\dots \dots 0.405$	Violet.
44	0.409 (Violet.
"	0.436	
Cadmium	0.468 }	Blue.
	0.480	

Metal.	Wave-length.	Color.
Mercury		C
Cadmium Mercury		Green.
46 ****	0.577	Yellow.
Cadmium	0.644	Red

The resulting color is stated to appear to the eye as white as that of an arc lamp, and to reveal the colors of surrounding objects in apparently natural tints. The efficiency is also stated to be comparable with that of the quartz lamp, being, with the 600-watt type, under 0.2 watt per H.K.

Particulars are also given of experiments with various forms of starting de-The electrodes being solid in this lamp, the starting up presents distinct difficulties which are absent in the mercury lamp proper. One of these is distinctly novel and utilizes the deposit formed on the cold tube. This metallic layer enables the lamp to conduct before the metal is vaporized, and the resultant ionization soon leads to complete starting up of the lamp; when the lamp has heated up the metal deposit disappears. This method is only applicable with metal electrodes. The author has also experimented with a graphitic anode. In this case the tipping method is applied, the graphite being attached to an iron chain. When the lamp is tipped the graphite anode slips down the tube and makes contact with the cathode; as the lamp is rocked back again it recedes to its former position at the end of the tube.

It will be interesting to see how this new lamp develops and how its qualities are maintains?

THE HYGIENE OF LIGHT

BY · LEONARD · KEENE · HIRSHBERG AB · MA· MD ·

The fire light and the light of the pine knot, with which the hut, the hovel or the wigwam were lighted, were objectionable chiefly because of their inconvenience, smoke and flare or flicker. The invention of the lamp without chimney, and of the candle, marked a step forward, though their light was weak and flickering. A much greater advance was the invention of the lamp chimney, as it provided what nothing else had done, steadiness of flame and avoided flare and flicker. Once the latter was overcome it became easy to improve the fuel, until now the oil lamp with chimney not only illuminates and decorates the home of wealth, but also brightens and cheers the hut of the fisherman and the cabin of the sailor; it aids and comforts the seamstress in her toil in the humblest lodging; it warns the mariner by night from dangerous coasts by lighthouses, and throws about the student a warm and cheerful radiance as he "burns the midnight oil." Candles are still much used both in churches and in houses, but chiefly because of sentiment or for decoration. They still furnish the softest and most beautiful light, especially for quiet places, but they are unfit for reading purposes because of their flickering and their feebleness.

The introduction of gas lighting was a great advance over lighting by lamps, owing to its convenience and cleanliness and the intensity of the light afforded. But gas lights, unless provided with chimneys, are generally unsteady and therefore objectionable for use in reading. Gas lights also produce much heat, and by this as well as by their products of combustion may greatly vitiate the air of rooms in which they are used.

While some kinds of illuminating gas are more poisonous than others, all manufactured—as distinguished from "natral"—gas contains a considerable per-

centage of poisonous constituents. When the gas is burned these are oxidized and form harmless substances, and hence there is little or no danger from the products of its combustion. But the greatest care should be taken to avoid the entrance in any way of unburned gas into the air of a room. This may happen by the gas escaping through leaky fixtures, or after "blowing it out" instead of turning it off. It may also occur when the light has been turned down very low in the sleeping room and is afterwards blown out by a draft, or goes out because of lessened pressure in the main, and the unburned gas escapes freely when the pressure is restored. Still another source of danger exists when the gas cock used to turn off the gas works too easily in its socket, and so is capable of being turned on by slight jars, touches and other means. Illuminating gas is also explosive when mixed with air in certain propor-

Electric lighting is in many respects an ideal method, giving a convenient, steady and powerful light, but, as is stated in the next paragraph, care must be exercised that such light is not too bright.

Probably there is no one kind of light which is best for all purposes. For general illumination of public squares and public buildings the electric light seems to be generally preferred. thing is probably true of private houses. For reading and for microscopic work, on the other hand, the electric light may easily be too bright; but this objection can be overcome by using lamps of proper candle power, by having the lamp at suitable distance, or by using bulbs with ground glass. The same thing may be true of the light yielded by any incandescent solid, such as the "lime" light and the various "mantles" made from incombustible earths. In general, for reading, a "soft" light is best, and it is desirable to have the larger part of the light come to the book by reflection from the walls of the room rather than solely and directly from any source of light near by. For this reason, dark-colored walls are objectionable for rooms in which a number of people do much reading, sew-

ing or other near work.

The ease with which the details of an object are seen depends chiefly on the contrasts of shade and color which these details present to the eye, and nothing so influences this contrast as the amount of illumination. Thus, as the light fades in the evening, the white paper of a printed page becomes darker and darker, until finally it reflects to the eye little more light than the black ink of the printed letters, which consequently no longer stand out clear and distinct. In order to admit all the light possible, the pupil enlarges, and in so doing lessens the distinctness of the retinal image; more important than this, we hold the page closer to the eye, thereby enlarging the retinal image and increasing the intensity of stimulation, but throwing far more work upon the pupillary muscle to focus for the near object. All of these unfavorable conditions taken together place undue strain upon the mechanism of accommodation.

Hardly less objectionable is excessive illumination of an object. After a certain intensity of light is reached, the retina no longer responds to increase of stimulation with increase of visual reaction. If there were in addition to our sun a second sun, which sent into the eye twice as much light, the second sun would seem no brighter than the first because the effect of the first upon the eve has already passed the point which calls forth the greatest possible reaction in the retina. To apply this principle to the case in point, we have only to remember that a printed letter is not absolutely "dead black," but reflects some light. When the illumination is moderate this reflected light hardly affects the retina at all, and the contrast between the black letter and the white paper is marked. As the intensity of illumination increases, however, the effect upon the retina of the light coming from the letters increases more rapidly than the effect of that coming from the paper. Contrast is lessened and sharper accommodation as well as closer attention is needed to see distinctly. Added to this, no doubt, is the fatigue and lack of sensitiveness in the retina, re-

sulting from overstimulation.

The use of fine type should be reduced to a minimum, because it necessitates greater effort of accommodation and intensifies all the evils of improper illumination. Any printed matter which must be held less than 18 in. from the eye in order to be seen clearly is undesirable for long-continued reading. Especially is this true in youth, since then the eye is more plastic and excessive strain of the muscle of accommodation, pulling as it does on the eye coats, may lead to permanent deformation of the curved sur-The marked increase of near sightedness within the past forty or fifty years is explained in this way.

Closely connected with the size of the type is the character of the paper on which it is printed. This should be as dull as possible in order to avoid the confusing effect of a glossy surface. The use of highly caletndered paper in many books and serial publications, because such paper lends itself more readily to the reproduction of pictures in half tone, is a sacrifice of hygienic considerations to

cheapness.

The source of illumination for near work should be as free as possible from unsteadiness or flicker, since a flickering light necessitates the most accurate accommodation. A "student's lamp," "tungsten burner," or incandescent electric lamp is preferable in this respect to candles, gas jets and arc lights for near work.

For the same reason caution is demanded in the matter of reading on railroad trains. American railway trains have recently become so heavy, and the roadbed and rails have been so much improved in various ways, that the danger of reading or writing while traveling by rail is much less than formerly. At the same time the danger still exists, and reading on many railway and trolley cars is still to be done with caution, or, better still, avoided altogether.

Microscopes, telescopes and other optical instruments require close and so re-

times continuous use of one or both eyes, and are popularly supposed to be "hard on the eyes." But this is not necessarily the case, except for beginners and investigators; for beginners, because they try to see clearly by focusing with the eye rather than with the use of the focusing apparatus of the instrument; for investigators, because the eyes are used for too long periods at a time. Optical instruments are easily focused, and, if care be taken to provide good lighting, routine work with them need not be specially trying to the eyes.

Particles of dust, cinders and others are often washed away from the surface of the eyeball by the copious secretion of tears which they call forth. Sometimes, however, they must be removed directly from the eveball or the inner surface of the eyelid. In the case of the lower lid this operation presents little difficulty, for the eyelashes of this lid are easily seized, the lid drawn forward away from the eyeball, and the surfaces of the eyelid and eveball readily inspected. If any foreign body is there located it may be removed by the corner of a handkerchief. Successful manipulation of the upper lid is more difficult, because a piece of cartilage immediately above the evelashes interferes with turning back the lid. The gaze of the patient should be directed downward, a small pencil or other cylindrical object pressed against the upper portion of the lid, above the cartilage, the eyelashes seized and the lid turned upwards and backwards over the pencil.

To summarize, we may remind you that the eyes, no less than other organs, should be kept sound and strong by attention to the general health and welfare of the body. Work, play, rest and sleep, muscular exercise, wise feeding and regular removal of the wastes-these and all other general hygienic habits help to keep the eyes sound and strong; but besides these, posture in work, lighting, paper, printing, dust, cinders, smoke, acid fumes, traveling, sight-seeing and many other conditions have their effect. Finally, it must not be forgotten that the eyes are too precious to be trifled with, and that if one has sore or weak eyes, or pain in the eyes, or cannot see clearly to read or to write, or cannot plainly distinguish things near or at a distance, then it is always best to consult an oculist or the family physician for advice. Remedies or doctors puffed in generally high-sounding advertisements should be carefully avoided.

ACETYLENE ON PANAMA CANAL

About sixty acetylene buoys, and thirty lights and beacons will be installed throughout the Canal from the Atlantic entrance to Limon Bay, through Gatum Lake and Miraflores Lake to the Pacific entrance, a distance of about fifty miles.

The buoys have been designed to meet the special requirements of the Isthmian Canal Commission, and are all equipped with 6th order lanterns having an optical light range of about twelve miles. Each light will have its distinguishing characteristic, and for this purpose the lanterns will all be equipped with flashers, some producing single, others complex flashes. With reference to the range lights, two installations have already been established at the Pacific entrance. These produce a very powerful light, having an optical range of more than twenty miles. These are also provided with flashers, but the flashes occur so swiftly that the impression of the light is retained continuously on the eye, so that the navigator can lead up to the range with the same ease as he would to fix lights, besides having the additional security of a distinctive light character impossible of being confused with shore or ship's lights. This is an interesting installation.

Sht- Its Relation to Electric Signs

It seems almost incredible to think that scarcely ten years ago there were not more than one or two electric signs on Broadway, New York City. To-day the famous "great white way" extends from Fourteenth street to Seventy-second street, lined on each side with spectacular electrical signs and illuminated advertising signs which make New York's famous thoroughfare the most brilliant street in the world and cause the civic lighting to sing into insignificance.

Of course, the general advertising signs have stimulated, if not forced, merchants and amusement resorts to erect signs on their own places of business. A building on the "great white way" without some sore of illumination would be lost. The combined effect of the whole, however, is interesting and harmonious to a surprising degree when it is considered that it developed of itself without any guiding hand. There is no more eloquent testimonial to the pleasing and effective qualities of light for advertising purposes.

In connection with the thirtieth anniversary of the lighting of the first electric light in New York, Mr. Gude, president of the O. J. Gude Company (often referred to as "creators of the great white

way'"), said:

'Electricity has made two advertising flowers bloom where only one grew before. It has added a night-time audience to the day-time audience of the outdoor

advertiser.

"The fundamental principle of outdoor advertising is that 'he who runs must read.' Practically all other advertising media depend upon the willingness or even co-operation of the reader for the absorption of the advertiser's story, but the outdoor advertising sign asks no voluntary acquiescence from any reader. It simply grasps the vantage point of position and literally forces its announcement on the vision of the uninterested as well

as the interested passer-by.

"Sight-seeing coaches nightly take strangers up Broadway to see this phantasmagoria of lights and electric signs. It is a great free exhibition for strangers from all over this country and Europe. Broadway is one of the sights of America that paints its picture so vividly on the mind of every visitor that it has become an accepted truism in Europe that the three great memories the traveler brings back with him from America are the wonderful, awe-inspiring Niagara Falls, the gigantic skyscrapers of New York City, and the electric advertising signs of the

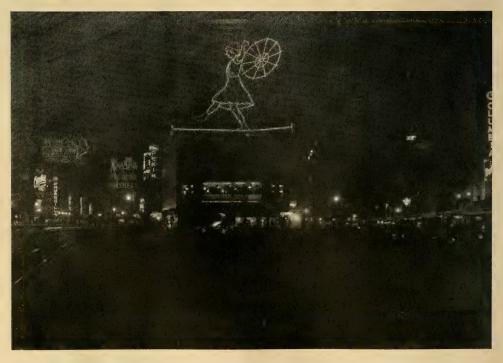
great white way.'

"And electricity has helped advertising in other ways than in doubling the time for the display of signs and increasing their interest. It has hastened the arrival of that day which I visioned in the concluding words of an address delivered before the Architectural League of New York City some years ago, when, in answer to protests about signboards marring the city beautiful, my argument was that the advertising sign, as it then was, reflected the mental condition and attitude of the public. I said that it was the advertiser's desire to place before the people in public announcement that which the people would most appreciate and pay the most attention to, and that a greater appreciation of art by the public itself would automatically bring forth more beautiful and artistic signs."

Electric lighting has been craftily appropriated by outdoor advertising experts, and it is now a most



FIG. IA.—FLASHING SIGN, SHOWN IN TWO PHOTOGRAPHS. FIRST DEPICTS NAME OF COMMODITY.



F: IR.—ONE OF SEVERAL POSITIONS OF GIRL IN THE ACT OF BALANCING HERSELF, ASSISTED BY PARASOL. MULTI-COLOR LAMPS USED.





FIG. 2.—FLASHING SIGN. FIRST VIEW AT RIGHT, FOLLOWED BY SECOND VIEW OF DANCING BROWNIE AT LEFT, WHO, WITH FEET WIGGLING AND EYES TURNING FROM SIDE TO SIDE, TUGS AT BRISTLES IN BRUSH. "WHITE" LAMPS USED.





FIG. 3.—FLASHING SIGN. FIRST EFFECT NOTED AT LEFT, FOLLOWED BY EFFECT AT RIGHT. THE WINKS ONE EYE. RED, GREEN AND "WHITE" LAMPS USED.



FIG. 4.—SHOWING POLO PLAYER ON HORSE'S BACK IN THE ACT OF STRIKING BALL. BOTH FIGURES IN MOTION. RED, GREEN AND "WHITE" LAMPS USED.

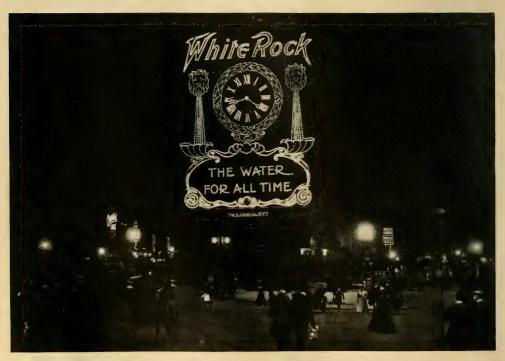




FIG. 6.—DEPICTING GIRL SKIPPING OR JUMPING ROPE. YELLOW, GREEN AND "WHITE" LAMPS USED.



FIG. 7.—VIEW LOOKING NORTH FROM TIMES SQUARE, BROADWAY TO LEFT, SEVENIA AVENUE TO RIGHT, SHOWING SIGNS AS EXISTED A FEW MONTHS BACT

the advertising and persistent of all media, without rival since the day the first mer-

chant put a sign over his door.

Perhaps one of the best evidences that electric signs are good advertising and good business is the way in which the "great white way" is regarded by the residents of European cities, where civic beauty has been studied and sought after for centuries. One of the most recent and expressive tributes to the "great white way" is that of Arnold Bennett, the famous novelist, who, in his first article on "Your United States," published in Harper's Magazine, said:

"I knew then that I was in a great

city.

"The rest of the ride was an enfevered phantasmagoria. We burst startlingly into a very remarkable deep glade—on the floor of it long and violent surface cars, a few open shops and bars with commissionaires at the doors, vehicles dipping and rising out of holes in the ground, vistas of forests of iron pillars on the top of which ran deafening, glittering trains, as on a tight-rope; above all that a layer of darkness; and above the layer of darkness enormous moving images of things in electricity—a mastodon kitten playing with a ball of thread, an umbrella in a shower of rain, siphons of soda water being emptied and filled, gigantic horses galloping at full speed, and an incredible heraldry of chewing gum. . . . Sky signs! In Europe I had always inveighed manfully against sky signs. But now I bowed the head, vanquished. These sky signs annihilated argument. Moreover, had they not been made possible by the invention of a European, and that European an intimate friend of my own? I suppose this is Broadway, I ventured. It was."

Mr. James Hoyt Lowe, an English civic reformer, when he first viewed the electric signs on Broadway, said they solved the problem of unsightly bill-boards. He further said:

"I came over here to see what you are doing in the way of civic reform.

"Although you are quite youthful, I believe you are ahead of the old world on lots of things.

"This billboard nuisance is one I think the whole world is interested in, and as soon as I walked up Broadway the other night and saw that magnificent display of artistic electrical signs illuminating not only the thoroughfare, but up to the very heavens, it occurred to me, 'Here is the solution of the inartistic billboard nuisance.'

"There is nothing unsightly or objectionable in any way. They are beautiful

and amusing.

"Give your billboard man more liberty and he will create in the heart of the city really beautiful billboards. They will be so much finer than the ones in vogue now that the small billboard man who cannot afford to hire good artists and erect handsome displays will be driven out of business. His boards will be so inferior the advertiseres will not patronize him, because they will realize that the public pays no attention to the common looking, inartistic advertisement."

The accompanying photographs show some of the more recent creations, and we understand that others of even greater beauty and magnitude are in course of de-

velopment.

Electric sign advertising seems to have struck the popular fancy. It approaches the public courteously, and is welcome; it is absolutely sincere and does not force itself on the attention of one when seeking the news of the day in the newspapers, or on the reader seeking diversion in the columns of his favorite magazine. An admirer of the beautiful "White Rock" clock, which until recently occupied a prominent position in Longacre Square, summed this up eloquently, as follows:

"He took the best spot in civilization, placed his advertisement there, and not only in a beautiful manner, but in a useful way; bowing kindly and courteously to everybody that passed by, telling everybody that looked at his announcement the

time of day."

Use electrical signs!





RAILWAY SIGNALLING AND THE LICHTING THEREOF BY DIXON BOARDMAN



Since the first savages discovered that fire could be produced by rubbing two dry sticks together light has been used for signaling. Not only were beacon fires used thousands of years ago to denote the approach of an enemy and the need of concentration, but crude attempts at heliographing were practised and communication established over long distances by flashes of light. Light has been the most important element in indicating danger or safety by land or sea from prehistoric days to the present time, and it is not surprising that in safeguarding modern railway traffic light is an element of prime importance. Railway signaling by day is primarily by position, and in the night by color. Since the greatest danger lurks in the dark, the lighting of signals and the color indications are subjects for grave study.

The signaling of our railways is a matter that concerns all our people, since it must now be considered not only from the viewpoint of a passenger, but also that of a voter. During the last few years bills have been introduced in almost every congressional session to compel the interstate railways to protect its lines by block signals. Some state bills of this nature have already been passed, notably in Indiana, and the Interstate Commerce Commission have appointed a sub-commission to study the subject on interstate railways. It is probable that federal legislation on this subject will be enacted shortly, and it is worth some study by every citizen interested in public affairs, as well as in the safety of the traveling public.

The approved forms of block signaling theoretically eliminate railway collisions and most of the causes of derailments—in practise it reduces these two kinds of train accidents to a minute fraction of

those that occur on unsignaled lines. There is only one argument ever advanced against block signals, and that is the expense. On roads of heavy traffic the saving in time and the increase in the amount of traffic that can be handled are so large that the cost of the signals is more than made up by increased earning power. On railways of infrequent trains a modern block signal installation will not pay its way if the railway is reasonably lucky in avoiding costly accidents. The question for the Legislature and the public to decide is whether the railways should be forced to this expenditure for the protection of life.

Unquestionably, railway officials have been backward about installing block signals in the past. It was only a few years ago that the remark "signals are a luxury" was made by most of the railway men in answer to queries on the subject indeed, a flippant viewpoint on the protection of life. At present the railways are rapidly equipping their lines, yet of the 245,174 miles of road in operation on January 1, 1912, but 76,415 miles were protected by block signals. Of this mileage only 31.2 per cent. of the total, 20,-335 miles used automatic signals, and 56,-075 miles had mechanical signals. That the adoption of block signals should be hurried seems clear; but whether the legislation would not tend to force the railways to adopt the cheapest and least efficient kind of signaling is a question.

It is inevitable that we should compare the results in this country with those in England, since no English railway (excepting specially exempted branch lines) is allowed to operate without a complete system of block signals. The English mileage is but little over one-tenth of that in the United States, but the density of traffic is so much greater that the number

of passengers carried and the passenger train mileage is not enormously less than our own. Also, British passenger coaches are so lightly built that wrecks produce a greater number of fatalities than in our stronger cars, and their trains average a higher rate of speed than do ours. In the following statistics "train accidents"



AUTOMATIC SIGNAL AT "CLEAR."

means collisions and derailments (although there are few injuries from boiler explosions, etc., included), and so were avoidable had a perfect block system been implicitly obeyed.

STEAM RAILWAY ACCIDENTS, U. S. A.

	Years	ending Ju	ne 30.	
	Pas-	Pas-	Em-	Em-
	sengers	sengers	ployees	ployees
Years.	killed.	injured.	killed.	injured.
1911	142	6,722	633	6,775
1910		7.516	715	6,791
1909		5.865	520	4.877
1908		7,430	642	6,818
	ELEC	TRIC RAIL	WAYS.	
1911	75	1,163	16	118

In Great Britain I have only the figures for the number of passengers killed for three years, which were fourteen in 1911, twenty-three in 1910 and none in 1908.

In the following paragraphs the reader will find a brief description of the development of signaling, the kind of signals in use at present, and how the lights give the night indications. It will give a general understanding of the present status of the railway signaling art, and be a basis for forming an opinion as to whether or not the railways need the stimulus of legislative compulsion towards completing the protection of their passenger trains by block signals.

In the middle of the last century, when the railroads had acquired too great density of traffic to operate trains without a perceptible chance of collisions, the first attempts at signaling were inaugurated. These signals were placed at stations and at passing sidings, and were used to tell the engineer whether or not he was to stop for orders. As the traffic grew, train dispatchers manipulated the trains by not allowing one train to move until the preceding one had plenty of time to reach the next station, or the passing point. signaling which was used under this system was called "time interval signals," and they had the fatal defect of not allowing for break-downs or unusual delays. It finally occurred to some astute man that a space interval was needed, and not a time interval, and it is the space interval idea that is the basis of block signaling.

Block signals are spaced a given distance apart and required to be held in the "stop" position while any train is between them. Thus a following or opposing train is not allowed to enter a block section while it is occupied. Block signaling is divided into two forms, mechanical and automatic. Mechanical signals are either operated by a lever in a signal cabin or at outlying points by a lever at the foot of the signal, and the lever is moved by These signals are usually in the stop position, except when cleared to allow each train to proceed. They are called absolute block signals, because no train is allowed to pass them when in the stop position unless with a written order. When a train approaches the signal the man stationed in the signal cabin inquires from the operator in the signal cabin in advance, either by telegraph or telephone, whether the preceding train has passed his cabin and if his signals are set in the "stop" position. If the answer is in the affirmative, he knows that the track is free, and so clears the signal, allowing the approaching train to enter the block section. Immediately the train passes this point the signal is again placed in the "stop" position, and while the train remains in the block section it is protected in both directions by "stop" signals. No collision can occur if the signal operator performs his duty, and if no engineer disregards the "stop" signal.

It is found in practise that extremely few accidents occur where this system is used; but some accidents have occurred, and additional safeguards are used to some extent to prevent this possibility. New York Central, and some other railroads, have used what is called "The Lock and Block System," This means adding to the system just described electric circuits and locks which insure the automatic return to the danger position of a signal as soon as the train passes, and prevents any signal being again thrown to the "clear" position until the train has passed a point in advance of the succeeding signal. With this method in use no "proceed" signal can be given unless the block section is unoccupied.

The other dangerous possibility under this system is that of an engineer running by a signal in the "stop" position. Several disastrous wrecks have occurred from this cause, notably the one on the D., L. & W. railroad at Corning, N. Y., a few months ago. The best method of preventing this type of accident is the enforcement of standard of efficiency among railroad engineers. The mechanical means of preventing it is the automatic stop, i. e., a device for throwing on the air brakes if a train passes a signal in the "stop" position. This is accomplished in several ways, and is in use on short sections of several railways, and is in successful operation throughout the subway system in New York City. It is not a difficult engineering problem to devise a lug situated beside the track, which will stand upright when the signal is in the "stop" position and trip a rod, opening the air brake circuit on a passing train. This device works satisfactorily in subways, where it is not exposed to snow and ice. On the open roadway, both weather conditions and a high speed of trains, tending to cause breakage by this mechanical contact, operate against its successful use, and it is probable that no satisfactory method of using an automatic stop will be found until a purely electric one is devised. This idea would be an electric circuit running through the track rails, the wheels of the locomotive, and a magnet in the locomotive to control

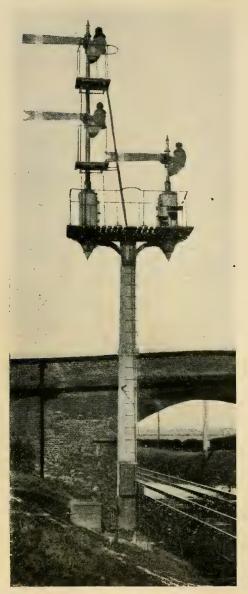


AUTOMATIC SIGNAL AT DANGER.

the operation of an air-brake valve. Doubtless, an arrangement could, and no doubt will, be devised on these lines which will automatically open a valve and put on the brakes when a train enters a block section that is occupied, or in which a switch is open.

While mechanical signaling, with the additional safeguards that may be used with it, gives a high degree of protection to train operation, it requires the employment of a great number of men, and on roads of light traffic becomes prohibitively costly. To reduce the cost of maintenance

automatic signals have been devised, and this method is fast being put in service, not only on unsignaled lines, but very largely in displacing mechanical signals al-



ELECTRO-GAS SIGNALS USED ON NORTHEASTERN RAILWAY OF ENGLAND.

ready in service. In 1878 Thomas Hall, the father of automatic signaling, placed the first automatic signal in service on a railroad. This was a disc type of signal, like that shown in the illustration, displaying a large red banner for danger and a clear white background for a "clear" indication by day, and a red or white light for these two indications by night. The movement of the light cloth banner and the colored glasses was made by the action of a magnet in the enclosed disc case. This magnet was energized by an electric circuit controlled by a series of track instruments which opened or closed the circuit as the wheels of moving trains depressed the lever of the track instrument.

The type of signal itself was so simple and reliable that, with very few alterations, it is still considerably used to-day; but the track instrument theory has been very greatly improved upon. Automatic signals are now controlled by a track circuit. An insulation is placed between each track rail at each end of a signal section, the rails at one end being connected to an electric battery and at the other end to a relay. There is, therefore, a continuous circuit running from the battery, through one rail, through the relay magnet at the other end of the signal section and back on the other rail to the battery. This relay controls the operation of the automatic signal, which goes to the "clear" position when the relay is energized and stays in this position until the relay becomes de-energized, when it automatically resumes the "stop" position. The entrance of a train into the block secshort-circuits the track circuit through its wheels and axles, thus deenergizing the relay and allowing the signal to go to the "stop" position. Also, an open switch, a broken rail, a wash-out or a car on a siding within fouling distance of the main line, will all interrupt the track circuit and bring the signal to the "danger" position. This track circuit principle in connection with automatic signals, and also the controlled mechanical signaling mentioned above, is probably the greatest safeguard to passengers on railroad trains devised since the introduction of the air brake.

While the disc signal is still used, most railroad men consider it advisable to use the same semaphore arm for automatic signaling as is used in mechanical signaling. The semaphore, as shown in the accompanying illustrations, is a board usually 4 ft. 6 ins. in length, indicating danger when in the horizontal position and "proceed" when inclined either upwards or downwards. The original practise was for operation in the lower quadrant, and usually used two semaphore blades to give indications. One blade was known as the "home signal." It had a square end, and was dropped to an angle of 60 degrees to show that the track was clear for one block section ahead. The caution signal was placed from one-third of a mile to one mile in advance of the home signal, had a fish-tail end, and showed by its position whether the home signal was in the "clear" or the "danger" position. When the signal blocks were short a home and a caution signal were placed on the same pole, the latter six feet below the former, and it gave an indication of the position of the succeeding home signal. Thus, the approaching engineer would know whether the signal section was occupied and he must stop, or whether one or two signal sections were clear before

All automatic block signaling is permissive; that is the signals may be passed while in the danger position. Mechanical signals are used as an absolute block, since an operator is always at hand to "clear" them or give a written proceed order. Since automatic signals act without human agency and may get out of order, a rule has been made requiring a train, when approaching a signal at "danger," to come to a full stop, wait for a few seconds and then proceed under control to the next signal. To make it entirely clear to every engineer that a signal is automatic, a semaphore blade with a pointed end, in contrast to the square end, is usually used.

It was found that snow and ice could occasionally cause the semaphore arm to decline when a "stop" indication was intended. The theory of all signaling is to cause any unusual condition to force a "danger" indication, since delays are naturally of much less importance than the possibility of collisions, and so the most modern practise is to move the signal arm in the upper quadrant for the "clear" position, instead of in the lower quadrant. It has also been found that one

signal may often be dispensed with by using three positions of a signal blade in place of two, and modern practise is therefore to use the horizontal position for "stop," the 45 degrees upward inclination as "caution or "one block clear," and the 90 degrees position upwards as "safety" or "two signal sections in advance clear."

The methods that have been successfully used in operating automatic sema-



DISC SIGNAL.

phore signals are by compressed air, gas, and an electric motor. The first semaphore signals that attained a high degree of efficiency were operated by compressed air, and a very simple and reliable signal of this type was, and to some extent still is, largely used on the Pennsylvania and other railroads. The disadvantage of this type is the high cost of the air condensing stations and the pipe lines conveying air to the various signals. With the improvements in other types of power signals this form is slowly going out of use on account of its relatively high cost.

To attain the same simple direct signal

movement as is gained by the use of compressed air, the Hall Signal Company, which has always been the leader in the signal art in this country, devised the electro-gas signal, which is shown in an accompanying illustration as in service on the Northeastern Railway of England. This signal derived its power from a tank of liquid carbonic acid gas placed in the ground at the foot of each signal. This method of operation proved highly reli-



ELECTRIC SIGNAL MANUALLY CONTROLLED.

able, and is to-day in service on many railroads throughout the country. The disadvantage of this type is that two forms of power are necessary, electricity for the controlling circuit and gas for the signal movement.

Improvements in the design of electric motors and of their application to signal movement has now progressed for enough so that the all-electric signal equals in reliability and exceeds in lower maintenance cost any other form, and, as far as we can see in the future, electric signals will become the standard. The signal mechanism has been reduced sufficiently in size and weight so that it is now prac-

ticable to place it at the top of the signal pole, directly connected with the semaphore blade, instead of the earlier practise of placing the mechanism at the base of the pole and operating through long connecting rods. Various types of these signals in different positions may be seen in the accompanying illustrations. operation of the most approved types has now reached so high a degree of efficiency that there is only one failure in many million operations of the signal itself. The most frequent interruptions come from the operation of the track circuit, pricipally due to water on the track causing short circuits. These failures, however, have been reduced to great infrequency, and approximately all of them create a "danger" indication when a "clear" indication should be given. There are nearly 100,000 automatic signals at present in operation in this country and Canada, each of which probably makes more than 25,000 movements per annum, and from available records there is an average of less than half a dozen false "clear" indications given during each year. Thus automatic signaling has reached so high a point of efficiency that collisions and derailments can be almost entirely eliminated by their use.

A separate branch of signaling is interlocking. This is the mechanical or electrical control, so that a switch can not be opened unless a signal is in the "stop" position, and the signal cannot be "cleared" unless the switches are aligned in accordance with the indication that the signal will give. Both the signals and the switches in yards, or at other points where a considerable number of cross-over or siding tracks are placed, are thrown by levers in a signal cabin. For small installations this is done mechanically, i. e., the lever is directly connected by wire or iron pipe to the switch or signal and the operator, when he moves these levers, directly aligns the track and its governing signals. In larger installations, and when it is necessary to use outlying signals at some distance from the signal cabin, this direct connection becomes difficult in operation and liable to failure. For these cases power is used.

For the movement of interlocked switches by power either compressed air or electric motors are used. In this case the movement of small levers in the signal cabin open or close circuits, allowing the switches and signals to be moved, and a return indication given to the operator to show that the movement is completed. Just as in automatic signaling, air was first used for this power, and positive and satisfactory operation resulted from its The improvements in electric apparatus, however, have sufficiently advanced so that electric motors may be used to throw the switches and move the signals with at least equal reliability, and with greater economy than by the use of an auxiliary power.

The operation of trains at night is attended by greater risk than in the day time, so that lighting of the signals is a subject of prime importance. A great deal of study has been given to the selection of the colors to represent the different indications and while all railroads do not agree in their practise, there are only some minor details which are not uniform. Modern practise uses red for danger, or stop; yellow for caution; green for safety, or proceed; blue for back lights; purple for dwarf signals, and lunar white for

marker lights. The main requirements for a color are maximum distinctness and requisite range. Of the four cardinal colors, red, yellow and green have the requisite range, and a sufficient degree of distinctiveness, and these have been adopted for the more important colors, which must be seen at a distance. The other cardinal color, blue, has both a short range and is not especially distinctive, since it tends to become greenish under certain atmospheric conditions, and so it is only used as a back light, that is, to distinguish a signal governing traffic in the opposite direction. Except for the cardinal colors the only other color that is both sufficiently distinctive and possessed of requisite range is lunar white. This color is more distinctive than vellow, has been strongly advocated for a caution signal and may in future be adopted for this use. At present it is principally used as a marker light, which is placed six feet below the signal light, so that if that light is obscured or out the engineer would know that he is approaching a signal. This

use of marker lights is coming into general use with the adoption of a one-arm signal giving three indications, in place of the older type of signal using a separate semaphore blade and light for the stop and caution signal. In the older form there were always two lights, and adding a second, or marker light, to the single light indication reduces the possibility of all the lights being extinguished or obscured. Purple gives a distinctive light but of very



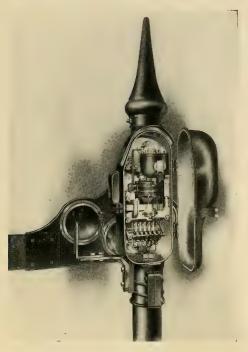
SWITCH INDICATORS SHOWING SWITCHMAN IF TRAIN IS APPROACHING.

short range, and has been adopted for dwarf or switch signals. These small signals, which are placed close to the ground, are used only at switches and in yards to show the track alignment and how the switches are set.

An illustration shows the holder where the signal lamp is placed and a view of the spectacle casting which holds the colored glasses that give the night indication. When the semaphore arm is in the horizontal, or stop position, the red glass is before the light; when it is at the 45 degrees, or caution position, the yellow glass catches the light; and at 90 degrees, or

the safety position, the green light is before the lamp. These spectacle castings are always made in what is termed the "continuous light" pattern; that is, some color is being shown at all times during the movement of the signal.

Red is the best color indication that we have, since it has a good range under any conditions, carries further than any color through fog or smoke, and is the least liable to change of tone or tint



HALL ELECTRIC SEMAPHORE SIGNAL SHOWING BRACKET FOR LAMP.

through atmospheric conditions. For these reasons, red has universally been adopted for the most important indication, the danger one. Yellow has a greater range than any of the other colors, and is reasonably distinctive, although under certain atmospheric conditions it may become either reddish or nearly white. It is because it is less distinctive than either red or green that it is used for the caution indication, which does not require as great a degree of positiveness as either danger or safety.

Kerosene lamps are usually used in signal lighting. The ordinary lamp, with a 5%-in. flat wick, gives at the flame from 1½ to 2 candle-power, and from 40 to 60 candle-power with lenses. The sevenday lamps, which are now principally used on account of the great reduction in the labor cost for lighting and refilling them, have a ¼-in. round wick, giving from .45 to .60 candle-power at the flame and from 25 to 45 candle-power with lenses.

Photometer tests under good atmospheric conditions show the following estimated ranges with a 40 candle-power beam through a lens:

Medium												
Medium	yellow										3.93	4.6
Lunar w	hite										3.09	66
Medium	oreen										3.05	66

These are the only colors that give a range of 2 miles. Of the other colors used the range of blue is approximately 1 mile and of purple approximately ½ mile. As explained above, while purple has a short range, it is a very distinctive color, and so it has wisely been adopted for dwarf signals in yards which do not need to be seen at any appreciable distance.

Of the atmospheric conditions that decrease the range rain is not very important, since it is estimated that the carrying power of these lights is only reduced 30 per cent. through a heavy downpour. Snow is much more dangerous, and it does not take a heavy snow storm to reduce the range from more than three miles to less than one mile. As to fog, that may be so thick as to almost totally obscure the light. In England no dependence at all is placed on signal lights during the heavy fogs, and men are called out to guard each signal, giving orders by word of mouth to the slowly moving trains.

During the last two or three years acetylene lights have been tried to some extent for signal work, and have given great satisfaction. As they are now used on some parts of the Boston & Maine and the Lehigh Valley railroads they give 2½ candle-power at the flame and about 75 candle-power through the lens. The light is very pure white, carrying well through the various colored glasses and giving rather more distinctive colors than does the kerosene light. Whether acetylene will be extensively used is a purely economic question between the saving inla-

bor and the increased first cost. The acetylene tanks contain 275 feet of gas, and the continuous light uses 2 feet per 24 hours. With the use of this acetylene lamp men are unnecessary, since the lights burn continuously for months, and the cost of the gas is only \$15 per 1,000 feet, or 3c. a

An interesting innovation, which has not yet been tried in railroad practise, has been brought in through acetylene lighting, and that is the use of a flash-light instead of a steady light. The advantage of the flash-light would be to use it on automatic signals while using a steady light on mechanical signals, thus telling the engineer whether he was approaching a permissive or an absolute signal. It is quite as important to have a difference in the indication at night between these two forms of signals as it is in the day, and it is quite conceivable that this flash-light idea will be extensively used in the future. As it is operated at present, the light is dark nine-tenths of the time and shows

one-tenth; but the flash may be regulated to any proportion that is desired.

Electric lighting is used on most electrified railways and proves eminently satisfactory. Since power in abundance is available the consumption of the signal lights is relatively negligible. A 2 candle-power lamp is used.

Block signaling is an English invention and has spread from there over the world. as did most of the original ideas of railroading. Automatic signaling, now recognized as more reliable and economical than the use of human action, is the product of American inventiveness and is spreading to other countries. Electricity neither drinks, sleeps, nor goes out nights, and is the ideal watchful protector. The timid traveler, in these days of high speed and frequent wrecks, will do well to inquire about the signals in use on the railway he intends to use. Block signaling is more neglected on American railways than any one essential to the safe movement of trains.

THE EYESICHT OF SCHOOL CHILDREN

"Conservation of the eyesight of the children in our schools," says T. A. Woodruff, M.D., in the *Illinois Medical Journal*, "is a matter of vast importance. The foundation of subsequent eye disease is frequently laid in our schools. Defective vision and eyestrain are the causes of many physical maladies, which generally render the child dull and mentally incapable of performing the ordinary school tasks.

"If a community's best asset is its men and women, no pains should be spared to conserve the eyesight of its boys and girls. In a work so important, it is the duty of the school, the home and the State to act together. If any of these fail to carry out its part in this work, the boys and girls inevitably suffer. Parents are anxious that their children should be healthy and vigorous, and very often they are ignorant in the knowledge essential to promoting this wish.

"A dull, sickly pupil is a heartbreak to any energetic teacher, but the teacher, too,

is frequently unable, through lack of special training, to locate the pupil's physical limitations. The State is ready to do its utmost for its future citizens, but stands helpless because there are no ways and means of carrying out its good intentions. In the meantime the children bear the burden, and because nothing is done in their behalf, go through life needlessly and heavily handicapped. The ignorance and indifference of the parents and teachers to the visual defects is a menace to the future welfare of these small people. Few realize that such abnormal conditions are serious in the extreme, resulting in dullness, headache, stupidity and other nervous disorders that go to affect the health of our future citizens. Bodily vigor is impossible; if the child survives at all he is but a miserable second-best of what he ought to be. The pity of it is that these conditions are not remedied when a little timely skill and attention would accomplish so much for the sufferers throughout life."

ACETYLENE — © SOME OF IT'S USES

- BY D! ROBERT GRIMSHAW

"Competition is the life of trade" is an old and in many cases true saying; and it applies also to industrial science, which is the handmaid of commerce. Whoever doubts this has only to consider the question of illuminants, and see how electricity, instead of driving gas out of the market, has made of it a dangerous competitor. The introduction of acetylene is another example of the development of new methods and materials in a large field of usefulness. Its advantages have been heralded by those commercially interested in its introduction, while its disadvantages have been trumpeted abroad by their rivals. It is quite possible that the publication of its disadvantages has been one of the main factors in bringing about the various improvements in appliances for its manufacture and use. Certain it is, that of all the so-called "industrial" gases none has found so many and so widely different fields of application and usefulness as acetylene. It is not yet twenty years since it was offered with greater or less modesty as an illuminating material; and it was at once the subject of many an intelligent and many an unpractical invention. A proof of its worth lies in the fact that despite the foolish and often dangerous inventions which followed its first introduction, it has "come to stay"; so that on good (German) authority there are already employed in the production of calcium carbide no less than 280,000 hp., and the yearly output has a value of about \$17,500,000; the appliances for its manufacture and use representing a further annual expenditure of \$7,500,000.

The earlier years of calcium carbide were marked—like those of glucose, to give another familiar example—by the wildest speculation; but this has been succeeded by well-controlled business agree-

ments which despite the constant increase in selling price have at least kept the business on a sound basis.

Most of the acetylene manufactured, is, despite the great variety of applications of this material, employed for illuminating purposes, portable and other. In Germany alone there are over 150 public and 40,000 private acetylene gas works. It is probable that the total number of public acetylene gas works in the world already exceeds 1,000; and more particularly in tropical countries, where of necessity, as social life exists principally in the cooler hours of darkness, there is more need of artificial light than in northern climes, acetylene light is especially popular. Its employment for domestic heating and cooling has also tended to extend its field of usefulness.

As regards the odor of which so much complaint is made, it may be said that the products of combustion of pure acetylene are only carbonic acid and watery vapor, which neither alone nor in combination have any odor at all. While in the earlier stages there was undoubtedly reason for unfavorable reception of the gas by reason of its unpleasant and quite marked odor, nowadays the facilities and methods for the purification of the carbide and of the gas itself are so good that the difficulty may be said to be overcome.

Acetylene burns well in open flame and also with either ordinary or inverted incandescent "mantels"; and its intense illumination is unexcelled.

One of its greatest advantages is its adaptability for central stations for all sorts of conditions, at low cost for installation and operation.

There are several industries in which it seems to be driving out all rivals—for instance, in the manufacture of glass beads, where it is employed not only to separate the beads from the tube but also to round them; in textile manufactures for singeing clothes, in hat-making for heating the blocks, in chemical laboratories for the Bunsen burners, and the fire department finds it a very useful adjunct.

The army employs it in optical signaling: the surveyors in triangulation use acetylene heliotrope, Wahnshaff's means of which they can work at a distance of over fifteen miles; and it is also employed in railway and marine signal-

ing and illumination.

For the latter purpose, thanks to the Dalen appliances, it has attained almost universal recognition and application. Anchored buoys are used, consisting of a large gas reservoir which feeds a flame that is never extinguished, but the light of which is by means of a rotary shutter constantly interrupted in periods constituting a Morse signal. Such buoys, placed in dangerous locations, need to be tended only at long intervals-sometimes even a month. Dalen has gone so far as to enable the flame to be turned down during the intervals of the flashes, so as to reduce the gas consumption. There is even a device by which the flame may be automatically lowered during daylight, this being effected by Dalen's "sunvalve." This operates by means of two metallic rods, one of which is protected from the action of the light, the other, not; so that it absorbs the solar light and heat rays, the result being a difference in the expansion of the two rods, so acting on the cut-off that the gas is turned on only when darkness ensues-entirely regardless of the time of day. The device is so sensitive that a heavy cloud passing before the sun will cause the light to be "turned high."

Another of the inventions of this in-

genious Swede employs a rotating disk with tiny pockets filled with a mixture of acetylene and air, and so arranged that as each pocket reaches a particular position an explosion ensues. These explosions can be produced at the rate of 500 per minute, and their frequency determines the pitch of the tone produced. The apparatus is set in motion by a tuning fork, and on the approach of a ship having a fog horn with the same pitch, the tuning fork starts the disk and causes it to answer the horn.

In the line of life-saving devices acetylene floating torches have been introduced, which consist of buoys having a tube filled with phosphide of calcium and also a calcium carbide reservoir. entrance of water causes the formation of phosphoretted hydrogen, which ignites spontaneously and inflames the acetylene gas, giving the flame of 200 to 600 c.-p., which burns 60 to 80 minutes.

It would seem hardly necessary to mention all use of acetylene for automobile lighting.

Recently, orchard and vineyard proprietors have been using acetylene light

for attracting injurious insects.

But the most important industrial application of acetylene is for autogenous welding. It is superior to other gases for this purpose, for the reason that its combustion is "two-phased"—and that in the acetylene and oxygen flame there is a zone consisting of intermediate combustion products (carbonic oxide and water vapor) which have a reducing action on the metal. In Germany alone there are in use more than 12,000 acetyleneoxygen welding apparatuses. These are employed in the most important works as well as in the smallest forges, and are doing good work in all.

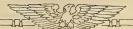
UNITED MUSIC



A clever musician in vaudeville entraps both the eye and the ear by having a small incandescent lamp mounted on each bell of the horn he uses. As he plays the lamp on the horn from which the sound issues, lights up. With the

footlights out and the stage darkened, the rapid flash of one lamp after another accompanying the notes, and the reflection in the bright polished surface of the bell of the horn make the act a decided novelty.







LICHTING EFFECTS ATTENDING NAVAL DEMONSTRATION NEW YORK

CLARENCE · L · LAW

When the sun set beyond the magnificent golden topped Palisades, what might perhaps be called the rarest spectacle of brilliant illumination ever witnessed presented itself during the early part of October. The greatest navy spectacle of modern times was to be seen along the Hudson River, reaching in great magnitude from the Battery to Spuyten Duyvil.

The history of this country or any other reveals nothing that compares with this vast mobilization of modern sea fighters. In all there were gathered 127 ships of all classes, with 1300 officers and

27,000 men.

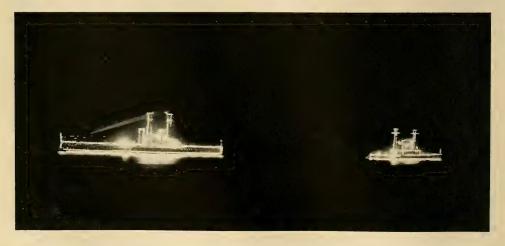
Riverside Drive, the vantage point from where hundreds of thousands of men, women and children viewed the floating fairyland, was itself not only festooned and outlined by thousands of tinkling incandescent lamps, but was illuminated by small, glimmering lamps placed in and among the trees, giving the effect of a heaven of twinkling stars. At

different intervals there were placed illuminated signs, giving names of passed, but not forgotten, sea heroes and expressions known to all true Americans. The first of these was at 129th Street, and read Bon Homme Richard, "I have not begun to fight"; next came Maine, "Public opinion should be suspended," and next Olympia, "Fire when you are ready, Gridley," and so on down the avenue of light.

each night being lighted at seven o'clock sharp at a given signal from the flagship Connecticut, this seven miles of lights blazed forth in stupendous glory. With the Jersey shore for a fitting background it is hard to conceive the impression one gets from this spectacle. Shooting and darting up and down the river were many

This lighting continued for five nights,

gets from this spectacle. Shooting and darting up and down the river were many small craft, shooting beams from searchlights lighting up first this huge mass of iron and steel, and then its little sister ship, not so massive by comparison, but

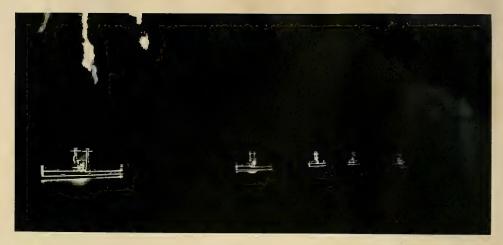


WARSHIPS OUTLINED WITH LIGHT.





TWO VIEWS ALONG RIVERSIDE DRIVE.



SUCH WAS THE WONDERFUL VIEW AS FAR AS THE EYE COULD "SEE."

having its comparative important function in this array.

This spectacle was presented at a cost of thousands of dollars to Uncle Sam, as well as to the city treasury. It was backed and handled by many public-spirited citizens, who gave valuable time, as well as many dollars, to see that a fit-

ting reception was tendered to our brave sailors and their officers.

It is hoped that other cities will follow in these lines for a perhaps even greater demonstration, showing how, by good lighting, dignity and grace may be accentuated, even in the most serious events which make epochs in modern times.

TELEPHONING WITH SEARCHLICHTS

Transmitting speech by means of beams of light, which is the way the earliest experiments in speech transmission were carried on, is to undergo extensive tests to determine its usefulness as a means of communication between ships in a battle fleet, states Popular Mechanics. So far, the gas-searchlight telephone has not proved effective in a range of more than three miles, even though the searchlights employed were of the most powerful type, but progress is hoped for through the continued experiments.

In the beam-of-light method of tele-

phony a microphone drum is so placed as to put the flame in a state of vibration corresponding to the speech waves. A large beam of light so controlled can be projected by means of a mirror to a considerable distance in the form of parallel rays, and at the receiving station can be concentrated upon a photo-electric cell of crystalline selenium, the resistance of which will vary according to the illumination and so affect a telephone receiver.

One of the most important features of searchlight telephony is that a message cannot be picked up except by those in line with the light beams.



ITS USE & MISUSE

A Primer of Illumination Prepared Under the Direction of the Illuminating Engineering Society



Organized in 1906 to advance the theory & practice of illuminating Engineering & to disseminate knowledge relating thereto. The Society now has about 1600 members who are interested in the subject of lighting from various standpoints: engineering, economic, hygienic, esthetic. The Society has no affiliation with any commercial organization. Any one interested in its objects may become a member.

It is the purpose of this publication to assists the user in making artificial light effective, whether the light be produced by oil, gas, electricity or otherwise.

By proper use you can get good illumination from any of these sources, but by misuse you are likely to get lighting that is bad, costly, and even dangerous to the eyesight.

ILLUMINATION AND COM-FORTABLE VISION.

To see easily and comfortably you must select the lamps, fixtures and globes and arrange the lights so as to best suit the particular conditions which have to be met, but certain principles which must always be followed may safely be laid

¹ To understand these principles better, take a

¹To understand these principles better, take a glance at the eye and see how it works. Fig. 1 shows the parts of the eye as they would appear if it were cut through from back to front vertically. In the process of seeing, the light passes through the cornea, pupil and lens of the eye to the retina, just as in a camera light passes through the lens to the sensitized film. The picture is formed on the retina, which is a layer made up of the ends of nerve fibers which gather into the optic nerve and go directly to the brain. The optic nerve sends along the picture to the brain for notice. The lens of the eye, unlike that of the camera, automatically of the eye, unlike that of the camera, automatically changes in thickness to focus or make a clear image on the retina for seeing at different distances. This fecusing action is called the accommodation of the

DON'T JUDGE ILLUMINATION BY THE Brightness of the Lamps.

Judge the light you are getting by the way it helps you to see. Do not think because a lamp looks glaring and brilliant that it is giving you good light. It may be merely giving you too much light ir the wrong place. On the other hand, a well shaded table lamp may look dim because it is well shaded, and still be giving first-class light for working pur-

You must get enough light to see by, and as you see things chiefly by the light which they reflect, it is evident that dark colored objects which reflect light badly require more light than do light colored objects to see them comfortably.

eye, and when the light is dim or bad the focusing

eye, and when the light is dim or bad the focusing muscle vainly hunts for some focus which may make objects look clear and gets tired in trying to do it. The muscles which move the eye about also get tired in the same way, and the result is eye-strain, which stirs up pain and headache just as any other overtired muscles of the body may set up an ache. The iris (which gives the eye its color) serves to regulate the amount of light which reaches the eye. In very dim light it opens out, making the pupil big, as shown in Fig. 2, and in very bright light it shuts up as shown, and thus keeps out a flood of brilliant light which might hurt the retina. The protective action of the pupil is pretty good, but by no means complete, for it seldom gets smaller than shown in the illustration, however bright the light.

w. 'h quite sufficient ewing on white loth, for example not do at all for working on blac woth.

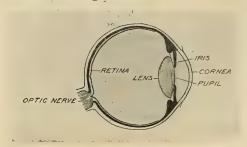


FIG. I.—THE EYE: ESSENTIAL PARTS SHOWN IN SECTION.

DON'T WORK IN A FLICKERING LIGHT.

See that your light is steady. If you leave a dark room and go into bright sunshine the sensation is unpleasant to the eye; if you use a light that flickers, you get this same unpleasant sensation, perhaps as rapidly as twenty times a minute. Furthermore, the eye endeavors to adjust itself to suit the light; if the light flickers it keeps the iris of the eve "see-sawing," as it were, and the muscle that governs it gets tired and reacts on the nerves to cause discomfort and pain. Reading in railway trains causes similar strain; the eye muscles get tired in trying to follow the shaking page, and are likely to provoke a headache.

Don't Expose the Eyes to an Unshaded Light.

It is bad to have an unshaded brilliant light glaring into the eyes, for it throws hard labor upon them in an effort at adjustment. This applies even to common electric, gas, or oil lamps. (See Figs.



FIG. 2.—PUPIL OF EYE EXPANDED TO LET IN PLENTY OF LIGHT WHEN ILLUMINATION IS DIM.

3, 4, 5.) While artificial light may be made a good substitute for daylight, you have constantly to beware lest rays that are too bright, either from the lamps or from their reflections, hurt the eyes. You can get reflections, so bright as to be harmful, from polished metal or glass, from bright varnished surfaces, or even from glossy white paper upon which the light falls.

A bright light fairly in the field of view means a very brilliant light on the retina, producing fatigue. Everyone knows the blinding sensation of looking at the sun with its sequence of dazzling colored images. Babies are here common sufferers when careless mothers or nurses allow them to lie in their carriages with eves exposed to the unclouded sun. Bright artificial lights, in a less degree, do the same thing to all of us. And when you get a bright light in the field of view, the pupil tries to shut it out; in so doing it renders less bright things all but invisible. Thus it is hard to see things which are nearly in line with a brilliant light, as you often find in facing an automobile headlight, or looking into a show window like Fig. 6.

A Couple of Simple Experiments.

Place an unshaded lamp in front of a picture on the wall and then stand back a few feet and note how much of the picture you can see clearly. Then hold a book or paper at arm's length so as just to cover the bright light and note the way in which the picture clears up. Again, put an unshaded lamp about a foot in front of your eyes and try to read a newspaper just beyond it. Then shade your eyes from the lamp and try it again. You



FIG. 2A.—SAME PUPIL CONTRACTED TO SHUT
OUT EXCESSIVE LIGHT.

will soon find out in this way that lamps can be so placed that they will be a hindrance rather than a help in seeing. (Compare Fig. 7 with Fig. 6.)

BEST DIRECTION OF LIGHT.

From time immemorial mankind has received its light mostly from the sky. Consequently the part of the retina on which the light from above chiefly falls is pretty well used to it, while bright light from below, falling on the part of the re-

Don't FACING THE LE T.

It is best we the light come from above and some mat sidewise, as a commonly does in nature, so that you will not get a brilliant reflection or glare from what you are trying to see. In reading and writing it is better to have the light come from the left, to avoid getting a shadow of the hand that holds the book or pen. Let the lamp be just far enough behind to keep direct reflections from



FIG. 3.—VERY BAD LIGHTING. THIS MAN RECEIVES, FULL IN THE FACE, BOTH DIRECT LIGHT FROM THE UNSHADED LAMP AND REFLECTED GLARE FROM THE TABLE TOP AND PAPERS.

tina which commonly gets light only from grass or dark pavements, may be very irritating and unpleasant. Thus the glare from snow and sand is not only disagreeable on account of its intensity but because of the unusual direction from which it comes. Just so with a brilliant beam reflected from glossy paper on which you are writing. Its rays strike you from an unusual direction and are harmful for that reason. Other smooth and shiny surfaces deliver an equally hurtful assault on that sensitive and much abused organ—the eye.

the paper out of the eyes. (See Figs. 8, 9, 14, 15.) But what has been said of reflections from paper applies with even more force to the case of polished metals, or the like, over which one is busy. Individual lights placed close over the work are very likely to produce these troublesome direct reflections and consequently such lights are falling into disuse. In an interior otherwise dark, their use is open to the further objection of giving bright spots of light and so producing too violent contrasts of light and shade. (See Figs. 16, 17.)

Don't Use a Bright Light Against a Dark Background.

Almost any light will glare unpleasantly if the surroundings are thoroughly dark. As an extreme illustration, the light from a big arc lamp hung close to the sidewalk may be very annoying at night, but by day you would hardly notice

oil lamps, open flame gas gets, upright and inverted mantle gas lamps, electric incandescent lamps of carbon and of tungsten, electric arcs of half a dozen varieties, besides mercury-vapor tubes, acetylene lamps, as used on motor-cars, and so on through a long list.

What do you wish to use a light for?



FIG. 4.—FAULTY ARRANGEMENT OF DINING-ROOM LIGHTING. THE LAMPS EXPOSED IN THE DOME SHINE IN THE EYES. TROUBLE IS AGGRAVATED BY GENERAL DARKNESS OF THE ROOM.

it. Just so a bright lamp against a dark background may be annoying, while against a light background it would not be so unpleasant.

LAMPS, FIXTURES, GLOBES, RE-FLECTORS.

One may choose to-day among lights of pany kinds. There are at hand candles,

To read or write by, to bring into view the working parts of a machine, to match colors, to display goods, or pictures; or merely to make a pathway safe and plain? Each case is to be studied by itself, and the effect is to be accomplished by such lamps, globes and reflectors as, properly disposed, will insure ample lighting without glare, and yet with strict economy.

However good and suitable the lamp, it will be put at a disadvantage unless the lighting fixture which carries it is designed to hold the lamp in the right position to enable one to best utilize the light which comes from it. Prettiness in a fixture is well enough; but let the fixture be serviceable first; then it may be also as pretty as you please. But don't buy prettiness if it makes war on good service.

by so placing the lamps that you may see with comfort anywhere in a room; second, in cases where a bright light is not necessary throughout a room, local illumination can be planned, placing the lights where they will be most used, always remembering that it will not do to localize light too much, since you need for comfortable seeing a fair quantity of light broadly distributed.

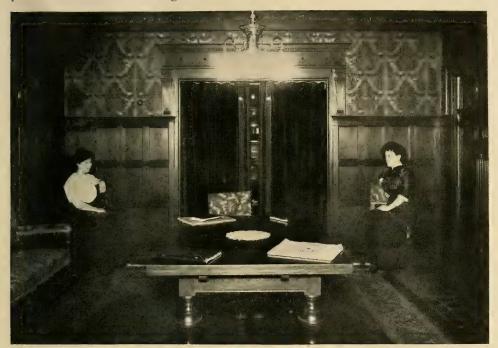


FIG. 5.—THESE LADIES ARE ANNOYED BY THE GLARE OF THE UNSHADED LIGHT WHEN THEY LOOK ACROSS THE ROOM. COMMON AND FAULTY ARRANGEMENT. LAMPS SHOULD BE ENCLOSED IN DIFFUSING GLOBES.

Daylight is naturally well diffused; but artificial light, poured out as it is from mere points, or narrow surfaces, needs to be tempered or softened by shades. And it sometimes further requires to be directed upon a desk or table or other object. In some cases it is better to adopt indirect methods, and throw the beams of a lamp upon a ceiling whence the rays are scattered. For every particular need there is ample provision amid the abounding lamps, globes and reflectors of present day designers.

ARRANGING LIGHTS.

Two methods are usual in arranging lamps: first, to secure general illumination

PRECAUTIONS TO BE TAKEN IN PLACING AND SHADING LIGHTS.

In any artificial lighting the lamps should be so well shaded that the eye does not see them directly nor brilliant reflections from them.

DIFFUSING AND SHADING BY GLOBES AND REFLECTORS,

You can accomplish this end by putting the light in duffusing globes of, for instance, ground glass or white or opal glass or other translucent material. To secure the best diffusion, the globes should be dense enough not to reveal the form of the



FIG. 6.—POOR ARRANGEMENT FOR DISPLAY. YOU SEE THE LAMPS INSTEAD OF THE SWEETS.



FIG. 7.—EXCELLENT ARRANGEMENT FOR DISPLAY. NO LAMPS IN SIGHT. EVERY GARMENT IS BRIGHTLY LIGHTED.



FIG. 8.—A BAD POSITION FOR READING. IN SPITE OF THE SHADED LAMP, GLARE FROM PAPER REFLECTED INTO EYES, IS VERY TRYING AND HARMFUL.



FIG. 9.—GOOD POSIT!ON IN READING. NO LIGHT DIRECTLY HITS THE EYES AND NO GLARE IS REFLECTED TROM THE BOOK.

actual light source within, but to give the effect of the light pouring forth from the globe as a whole. (See Fig. 10.)

Another way of accomplishing the same result is to put a shade around the lamp, which screens it and reflects downward much of the light which would otherwise idly fall on the walls or ceiling. (See Fig. 11.) Such shades may be of mirrors or polished metal or white or opal glass, of ground or prismatic glass—all of which, in a measure, work alike. Glass shades are generally preferable to metal ones, for a little light penetrates them sidewise—just enough to keep the upper part of the room from being too dark.

INDIRECT LIGHTING.

Another scheme successively used to shield the light is to turn the light from



OPAL GLASS GLOBE.

less some of the work in hand, as sewing dark goods or reading very fine print, demands exceptionally strong lighting in some parts of the room. In this case local lights may be added, but they ought not to be used without pretty strong general illumination. The commonest sort of localized lighting is that furnished by a table lamp. Such a lamp should always be shaded to keep the direct light out of the eyes—best by a translucent shade which will add something to the general illumination.

In any one of these plans for general illumination, lights should be so placed as to give at least fairly uniform lighting everywhere in a room, otherwise there may be strong and jarring contrasts of light and darkness.

In using shades open at the bottom,



GROUND GLASS GLOBE.

FIG. 10.—WITHIN EACH GLOBE IS A LAMP OF THE SAME CANDLE-POWER. NOTE THE SUPERIOR DIFFUSION OF THE LIGHT BY THE OPAL GLOBE.

the lamp upward on to the ceiling by means of an opaque reflector underneath. The reflector conceals the lamp, and the brightly illuminated ceiling by which the light is diffused serves as the actual source of the illumination. (See Fig. 12.) This plan should be used only on white or very light ceilings and is subject to a heavier loss for securing diffusion than some other methods, but often this loss is reimbursed by the thoroughness with which the ceiling diffuses the rays that fall upon it.

DON'T USE LOCAL LIGHTING BY ITSELF.

GENERAL ILLUMINATION USUALLY BEST.

n ordinary cases general illumination be best way of lighting an interior un-

such as are very common, their shape and character can be so chosen as to distribute the light precisely as desired; this result can in less degree be accomplished by using enclosed globes or by indirect lighting.

Any of the schemes here sketched can be made to give good results. The choice between them turns upon just what task is required of the light and what its surroundings are to be. Ordinarily, lighting from shades open at the bottom gives a stronger light than other methods, but you must carefully avoid glare in these cases. Lighting by wholly indirect means, in which all the rays are diffused from ceiling, demands lamps of extra power for the same illumination, but requires little care to avoid glare. Rooms lighted from dif-

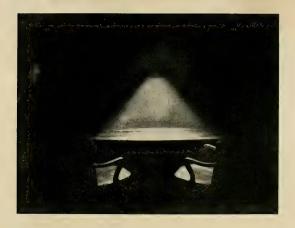


FIG. 11.—GENERAL ILLUMINATION BY DIRECT LIGHTING; LAMPS CONCEALED IN DIFFUSING GLASS REFLECTORS.



FIG. 12.—GENERAL ILLUMINATION BY INDIRECT LIGHTING; LAMPS ARE CONCEALED IN OPAQUE REFLECTORS AND THE LIGHT IS DIFFUSED FROM THE CEILING.

11



(a) Concentrating reflector: lights a small area brilliantly.



(b) · Semi-concentrating reflector: lights a larger area less brilliantly.



(c) Distributing reflector: lights a wide area moderately.

FIG. 13.—REFLECTORS PUT THE LIGHT WHERE YOU WANT IT; (A), (B), AND (C) HAVE LAMPS OF THE SAME CANDLE--POWER. (THESE PICTURES ARE INTENDED ONLY TO SHOW, IN A GENERAL WAY, THE EFFECT OF DIFFERENT TYPES OF REFLECTORS.)

fusing globes take an intermediate position with respect to freedom from glare.

MISPLACED BRACKETS.

For a lamp to do its best work, it should not be too near a wall, especially if this wall is dark. Hence only very small rooms can be well lighted by the usual side brackets, say 4 to 6 feet high. In a ECONOMY AND EFFICIENCY.

Don't Waste Light by Using the Wrong Reflectors.

By using reflectors you can put the light from a lamp where it will do the most good, much as an automobile headlight sends the light along the road just where it is wanted. In Fig. 3 there is a



FIG. 14.—DON'T PLACE A DESK LAMP LIKE THIS; IT GLARES FROM THE PAPER AND SHINES IN YOUR EYES BESIDES.

large room the eye cannot avoid glare from such barckets unless their lamps are so heavily shaded as to dim the room. In large rooms where brackets can be placed high enough to be out of the general view, they may be used to advantage; and they are often convenient for occasional use, as in bedrooms, when the room is also lighted by other means. lamp without any shade or reflector and you will see that the light goes in all directions, only a small part of it falling on the level of the table where it is needed. The rest hits the walls and is reflected about the room, losing intensity at each reflection. Obviously an unshaded lamp does not throw the light where it is wanted. To ensure the light falling upon the table

you must use a reflector that will bring it there.

Of such reflectors there are three general types, either of glass or of metal, which we may call concentrating, semiconcentrating, and distributing. (See Fig. 13, (a), (b) and (c).) The first acts almost like an automobile headlight, throwing its light downward into a comparatively small area. The second kind spreads out the light over a much wider

Don't Use Shallow Reflectors.
Height of Lamps.

All reflectors should come far enough down over their lamps to prevent you from seeing the bright sources of light themselves without actually looking upward.

With proper reflectors, their height above the table, counter, or bench ordinarily makes little difference since it is the



FIG. 15.—IF YOU MUST USE A DESK LAMP, PUT IT IN THIS POSITION. IF AN OPEN REFLECTOR IS USED LET IT BE OF THE DIFFUSING TYPE. BETTER STILL IS A REFLECTOR WITH A DIFFUSING GLASS BOTTOM.

area, of diameter perhaps as great as the height of the lamp above the table, while the third is planned to light a comparatively big area not very intensely at any one spot.

No reflector ever increases the total light that streams out of a lamp; it only puts the light where it is needed instead of letting it go unguided.

purpose of the reflectors to send the light where it will do the most good.

EFFECT OF DARK WALLS AND COLORED GLOBES.

Because dark walls absorb light strongly instead of reflecting it they demand much stronger lamps for sufficient illumination than do light walls. (See Fig. 18.) A very dark wallpaper or a dark wood finish may require three or four times as much light as a really light fiin-Dark reds, greens, and browns reflect only 10 to 1.5 per cent. of the light which falls on them. White, cream color, and light yellowish tints may reflect over one-half the light.

Likewise, deeply tinted globes and shades absorb much light—a fact which must be borne in mind in considering economy.

DON'T LET
LAMPS AND
GLOBES GET
DIRTY.

Dirt on lamp chimneys, electric



FIG. 16.—MORE LIGHT IN THE EYES THAN ON THE WORK AND NOT ENOUGH LIGHT IN THE ROOM. SHARP SHADOWS AND MUCH GLARE FROM THE POLISHED METAL. DISCOMFORT TO THE WORKER; LOSS TO HIS EMPLOYER.

bulbs, globes, or a flectors absorbs and wastes much light. The country over, it is safe to say that millions of dollars are wasted every year by letting lamps become foul and ust laden. Nor is there any economy in using electric bulbs until they blacken. It pays to renew promptly blackened bulbs and defective gas mantles.

DON'T SAVE LIGHT AT THE EX-PENSE OF YOUR EYES.

REAL AND FALSE ECONOMY.

Saving light at the cost of eyesight, is false economy.



FIG. 17.—EXAMPLE OF GOOD GENERAL ILLUMINATION IN A FACTORY; THE WHOLE AREA IS UNIFORMLY AND BRIGHTLY LIGHTED,

To get good lighting it is generally necessary to diffuse the light from the lamps either directly, by opal or ground glass shades. or indirectly, by turning the light first on the ceiling or wall. The use of ground glass involves the absorption of 15 to 20 per cent. of the light to secure diffusion. opal glass of various kinds from 20 to 40 cent., while per some forms of art



Fig. 18.—Each of these two little rooms receives the same light. Dark Walls absorb most of the rays of light in left-hand room.

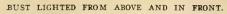
glass and most diffusing ceilings absorb more than half of the light that falls upon them. Even though all these appliances your eyes may tire easily even with good lighting. If so, consult an oculist and done glasses if you need them. Eye-strain often comes from defective eyes as well as from faulty lights.

ECONOMY IN SE-LECTING LAMPS.

In gas lighting there is no economy in using open flame burners unless the exposure is such that gas mantles

would often be broken. Similarly, with electric lights it is very wasteful in most cases to use carbon filament lamps when







THE SAME BUST LIGHTED FROM DIRECTLY
OVERHEAD.

FIG. 19.—BAD LIGHTING DEFEATS GOOD ART.

absorb light in the process of diffusion, there is gain in their use because they yield rays more grateful to the eyes. But

tungsten lamps are available. The carbon lamps cost less to install or replace, but much more for electric current.¹

AMOUNT OF ILLUMINATION REQUIRED.

The common unit of illumination is the foot-candle, meaning thereby the light which the object would receive from a standard candle at the distance of one foot. This is the measuring rod, as it, were, by which comparisons are made.

No absolute rule can be laid down for the number of foot-candles required for good seeing. Individuals differ widely in their requirements; and the conditions under which the light is used cause still greater variations in requirement. However, where lighting arrangements are well planned it has been found by experience that ordinary reading, writing, or work on white or light colored material, can comfortably be carried on by most people with an illumination of 2 to 3 foot-candles. For sewing dark goods, or reading fine type, 5 foot-candles are none too much, while for drafting, engraving, watchmaking, working on black cloth, and the like, from 7 to 10 foot-candles should be furnished.

How to FIGURE COST OF LIGHT.

How to FIGURE Cost of LIGHT.

¹The amount of electricity taken hy an electric lamp is expressed in watts. Most electric lamps now manufactured have the number of watts which they are rated to consume printed on a label on the bulb. The old-fashioned carbon filament incandescent lamp of 16 c.-p. has the candle-power on the label, and takes from 50 to 60 watts.

To determine the cost of operating an electric lamp, divide the number of watts it consumes by 1000 to reduce the kilowatts, and multiply the number of hours the lamp is to be operated by the kilowatts to obtain the kilowatt-hours of electrical energy. The kilowatt-hours multiplied by the rate

ARTISTIC EFFECTS.

In a room suitably arranged for comfortable seeing, you may have plenty of light, but the general effect may be displeasing. The illumination may quite fail to bring out the good points of the room in architecture and decoration, or may play pranks with the appearance of persons or things in the room. (See Fig. 19.) One may not object to ghastly tints in a factory, but in lighting a drawing room such effects would not be tolerated. Hence one often should sacrifice strict economy to get the most pleasing effect in the room. The fixtures that carry the lights should harmonize with their surroundings if the general effect is to be agreeable. Handsome fixtures have a decided decorative value whether their lamps are lighted As strongly colored objects give something of their own hue to all the light which they reflect, the color of lamp shades, walls, and furnishings plays an important part in the artistic effect.

per kilowatt-hour which is charged gives the cost of operation for the stated time.

The consumption of gas lamps is expressed in cubic feet of gas per hour. The number of cubic feet of gas per hour taken by a burner, divided by 1000, and multiplied by the cost per thousand cubic feet of gas, and by the hours of burning, gives its cost of operation for the stated time.

The consumption of open flame burners is commonly taken at 5 cu. ft. per hour. Upright single mantle burners usually take from 3½ to 5 cu. ft. per hour, though some smaller ones take less. Most individual inverted gas mantle burners take from 3 to 3½ cu. ft. per hour.

FOR NIGHT WORK AMONG THE WIRES

Probably the most disagreeable as well as the most dangerous task that falls to the lot of the lineman is night repair work upon electric light wiring. His inability to see properly multiplies his difficulties greatly and in order to overcome this a member of the staff of an Indiana electric light company has devised a hand searchlight which is illustrated by the Technical World Magazine.

The outfit consists of a small gas tank and lamp, such as are used to furnish light for motorcycles, and a special harness fitted to the lineman's shoulders for conveniently carrying the equipment.

The lamp is fitted with a handle by

which it may be carried and its light directed upon the work. It is connected to a gas tank by means of a small rubber tube. When the supply of gas is exhausted, the tank can be removed from the harness and exchanged for a new one at small cost.

It is asserted that the outfit is especially valuable in locating pole troubles, fallen wires, etc., and is so light and compact that it can be carried by a lineman without interfering with his work.

The maker gives the original cost of the outfit as follows: Gas tank, \$10; lamp, \$4; harness for carrying, \$2, making a total cost of \$16.

GLARE

The defining of this too generally apparent, disturbing and destructive condition seems to be a difficult matter. However, after all, we are more concerned in its elimination than in its definition.

Glare, resulting from the use of glazed (calendered) papers, and glossy inks, is much too prevalent—of this there is no doubt.

Observe the character of the paper and ink used in GOOD LIGHTING—and the lack of glare. The effect is much more comfortable to the eye, besides being pleasing to the aesthetic sense.

The Editor of GOOD LIGHTING has been experimenting for some time past in the effort to effect appreciable changes in typography, the results of which study will shortly find at least partial expression in this magazine.

Furthermore, it is planned to show, in an early issue, another development which is felt will tend to revolutionize a certain feature of the printing art, all of which advancement is in keeping with the broad policy now actuating the publication of GOOD LIGHTING.

DESK LIGHTING

BY M. LUCKIESH



Desk lighting furnishes a fruitful field for the misuse of light units. This is largely due to the fact that movable desk lamps are often carelessly placed by persons not familiar with the principles of illumination or by those who give the matter little consideration. Partly for this reason general lighting in offices finds ardent support among many interested in illuminating engineering. The old rule that daylight should come over the left shoulder and the desk lamp should be placed in front to the left of the user is as correct to-day as when first expounded. However, as any art develops, the rule may often be extended in scope to embody other principles resulting from intelligent observation and investigation.

This article describes a type of desk lighting unit whose design is the result of an investigation on glare from glazed papers.* By no means does the writer claim priority in this suggestion, but he takes this opportunity to briefly describe the reasons which establish a basis for the principle applied in this unit.

Besides the glare from a unit itself the greatest annovance is found in the glare due to regular reflection from the glazed papers which are so much used in publications. Glare from the light source can be eliminated by the use of general lighting system or by properly educating the user of the desk lamp. The unit described in this paper diminishes the annovance due to regular reflection because of the low intrinsic brightness of the source. Regular reflection from paper is merely the reflection of the image of the light source. The brightness of the paper due to this reflected image is practically constant for a certain unit while the brightness of the paper due to diffuse reflection from it varies inversely as the distance of the unit from the paper. It is seen at once that the brightness of the reflected image of the unit becomes more conspicuous as the distance between the paper and unit increases. This can be easily verified by holding a glazed paper very close to any kind of a unit. Annoying specular reflection will be absent in this case. Reading matter is often obliterated at the critical angle of regular reflection. This is due to the fact that the contrast between the type and background, when the paper is at a position such that the eye sees no directly reflected image, has been greatly reduced by regularly reflected light. This is largely the result of a high coefficient of specular reflection of the ink as compared with the paper. Simple numerical values can be substituted for the brightness of the paper and ink by diffuse and specular reflection and the above explanation becomes clear.



^{*} An Analysis of Glare from Paper. Elec. Rev. and West. Elec., June 1, 1912

Obviously the use of ink which produces an unglazed black surface is also of great advantage,

As long as calendered papers are extensively used desk lighting units of low intrinsic brightness will be found of great advantage. The unit shown in the accompanying illustration was originally designed for another purpose, but was readily converted into a very satisfactory desk lamp by placing a diffusing glass at the bottom opening of the reflector. A flashed-opal glass was found satisfactory owing to its highly diffusing property and comparatively low absorption of light. A 60 or 100-watt tungsten lamp furnishes sufficient light; the size, of course, varying with individual require-The unit can be hung low enough (about 14 in. above the desk), so that the diffusing glass is out of the field

of view, or skirting can be placed around the lower portion for the same purpose.

The ideal cure for this evil-glare from glazed paper-would be the adoption of paper (and ink) having a matt surface. This is admirably exemplified in Good LIGHTING in which is also illustrated the great possibilities from an artistic standpoint. Fortunately the paper most widely read-the newspaper-is of an unglazed character. This is indeed a most fortunate accident. But many publications running large numbers of half-tones adhere to the use of glazed paper owing to practical considerations. Difficulties are being overcome, however, and with increasing appreciation of the harmful effects of glare it is to be hoped that the day is approaching when glazed papers will be eliminated entirely from general use.

LICHT ADAPTATION

It has been demonstrated by actual trial, says A. E. Davis, M.D., in the Post-Graduate, that the sensitiveness of the retina to light impressions is greatly increased by shielding the eyes from light altogether for about thirty minutes. If at the expiration of that time the bandage is removed, the eye can perceive a trace of light that it was unable to before bandaging. In other words, what is known as the "light minimum," that is, "the minimal stimulus capable of being perceived, the threshold of sensibility" is reached. On the other hand, when the eyes are exposed to bright light for a

time, the sensitiveness of the retina is reduced, and after such an exposure it requires a great deal more illumination to produce the sense of light (light minimum) in such an eye than in the one that had been bandaged. This variation in the sensitiveness of the retina is called retinal adaptation, and obviously serves a very useful purpose. In the former instance, as when the eye is bandaged, it is called dark adaptation, and on the latter light adaptation. And this sudden change or adaptation of the retina is a factor, perhaps, in the production of the uncomfortable sensation felt in "glare."



TECHNICAL

STEPS · TAKEN · FOR · THE · REORGAN-IZATION · OF · THE · INTERNATIONAL PHOTOMETRIC · COMMISSION · · ·

The International Photometric Commission, commonly known as the "Zurich Commission," was created by the International Congress of Gas Industries which convened in Paris in 1900. This Commission, composed of representatives from the various national technical gas societies, with the co-operation of certain of the national laboratories, has been concerned with general questions of photometry in addition to its more specific functions in connection with the photometry of the incandescent mantle.

Inasmuch as there has developed a widespread appreciation of the need of an international, thoroughly representative commission to deal with general questions of photometry, and possibly also of illumination, it has been proposed that the International Photometric Commission be reorganized to fulfill these requirements in a way acceptable to all photometric interests. This movement is being well received both in Europe and America.

President Vautier of the International Photometric Commission has requested the Sub-Commisson on Photometric Units and Standards to formulate a plan of reorganization. This Sub-Commission was originally appointed at the 1911 session of the International Photometric Commission to consider the recommendations of the Illuminating Engineering Society (U.S.) regarding photometric nomenclature and standards. The Sub-Commission at present is composed of the following members: Dr. Brodhun, Dr. Kusminsky, M. F. Laporte, Mr. C. C. Paterson, Secretary, M. Th. Vautier, exofficio, and a representative of the United States soon to be appointed. The personnel of the Sub-Commission, composed of representatives of the various national laboratories, is peculiarly qualified to undertake the duty of formulating plans of reorganization. It is hoped that as the outcome of the efforts of the Sub-Commission, with the endorsement of the various national technical gas societies to which the International Photometric Commission in the past has been responsible, an essentially new Commission will be formed which will be equally representative of and responsible to all national technical gas, electric and illuminating engineering societies, and other societies interested in photometry and illumination matters.







VISION AND THE MEASUREMENT OF LIGHT & ILLUMINATION

BY ELIHU THOMSON COURTESY GENERAL ELECTRIC REVIEW

Were there no living creatures in the universe provided with eyes there would of course be no distinction between socalled visual rays and non-luminous or invisible rays. There would still exist the possibility and probability of the generation of that vast series of electric waves beginning with the lowest frequencies and ranging upward through rates of several hundred thousand waves per second as used in wireless telegraphy—through many millions per second—as in the waves investigated by Hertz, reaching at last the high frequencies characteristic of radiant energy given out by hot bodies such as the sun, and including those frequencies which correspond to visible light and even the ultra-violet rays, themselves invisible. All this range of wave frequencies are equally entitled to be called radiant heat waves, for they all represent energy which when the rays are absorbed in a body result in raising its temperature. much emphasis cannot be laid upon the fact that not only the dark heat waves, the ultra-red so-called, as well as those which excite the sensation of light in our eves, are all heat waves in the same sense, as are also those finer waves extending many octaves beyond the violet end of the spectrum. They all represent radiated energy, but the lower waves not only require more energy to produce them but give a correspondingly larger amount of heat when absorbed. The visual rays are limited approximately to only one octave and range from a frequency of about 400 millions of millions per second for the red rays up to about double that for the violet end of the visible spectrum.

Why, it may be asked, are not our eyes adapted to recognize a greater range of wave lengths than a single octave? The answer to this question doubtless is that

the organ of vision is a product of a long evolution during which unsuitable departures have been eliminated. It is probable that if our range of vision extended to lower wave lengths or higher frequencies than those now concerned in vision it might only lead to confusion instead of benefit, as some substances are transparent to ultra-red rays that are opaque to ordinary light, and others opaque to ultraviolet rays that are quite transparent to ordinary light waves. Again it is probable that, following the results of Prof. R. W. Wood in photographing with ultra-red and ultra-violet, similar contradictions to those found by him in the photographic effects, might equally exist in vision, which indeed may depend upon an effect upon the retina of the eye akin to photography. Just to the firefly has, by an exceedingly long process of evolution and elimination of the inefficient, become capable of producing light at the least cost, or waves confined to the visible spectrum without low or so-called heat waves and without ultra-violet, which would be useless for its purposes, the eye has been evolved for each animal to recognize most sharply those wave lengths most suitable to its life needs. A creature which always lived in a medium of a single color would evidently have no need of color vision for other colors. This condition must be approached by some of the deep sea fishes. Such fish are probably color blind to red, which is absorbed by moderate depths of sea water. Many of the insects, however, which seek the flowers must have a lively sense of color differences.

The birds, whose plumage is often highly colored and is different for the two sexes, must also have a highly developed color sense. The belligerent bull must likewise have an intense sense of red—

which causes him to charge a red cloth as if it were a wounded and bleeding enemy of its own scpecies. The Spanish bull

fight utilizes this blind instinct.

Even in man the faculty of color distinction varies widely. A considerable number of men are color blind, generally to the red rays, which involves the loss of its complementary, the green, since their white light is light green. It is said that some of the black races fail in being able to distinguish purple or violet from blue. Many years ago the writer found that a pupil of his was entirely color blind, seeing all objects in shades of yellow which was to him his only light, a very restricted range of wave length. He saw as if objects were illuminated by yellow light only, and they must have appeared as they do to persons of normal vision when illuminated by the yellow sodium flame. Color as such was absent.

The retina of the human eye is apparently capable of at least four distinct sensations aside from their intensity. These sensations differ, moreover, in their relative intensity over different portions of the retina itself. The simplest of these sensations is that of luminosity without color distinction, and this seems to be located in the so-called "rods" which are found microsopically in the retinal membrane. The other three sensations concern color vision, and possibly belong to the so-called "cones" which with the rods make up the retinal sensitive surface. We apparently see in three colors only, the intermediate shades being recognized by the varying degrees in which these three fundamental sensations are affected by any particular wave length of light.

In a very faint light though we may see objects, the rods only are assumed to be affected and color vision is substantially absent. This fact is impressed when one tries to distinguish by the eye which is the red end of the spectrum when a faint star is observed in a star spectroscope. No color is seen but merely a faint band of luminosity; and it is quite impossible without other means of testing, as by photography, to distinguish one end of the spectrum from the other. A slightly brighter star may give a faint color effect in the band,

and of course the spectrum of a bright star has the characteristic range of colors as in the solar spectrum. Unlike vision. the effect on a photographic plate with low intensities easily distinguishes the red from the violet end of the spectrum of even the faintest light sources, and indeed the sensitive film is capable of depicting objects where the luminous intensity is many thousands of times less than would affect the eye. Exposures of seven to ten or more hours with the largest telescopes are not unusual in recording the faint nebulous masses in the sky, the light effect being cumulative with the time. With the eye the effect is quite different. the dark the eye gains in sensitiveness, but long gazing in an effort to see a faint object is of little use; though curiously, faint objects such as minute points of feeble light may frequently be seen by averted vision instead of direct vision. Averted vision is made use of when the axis of the eye is directed not directly towards the object to be distinguished, but to a position at one side. This superior sensitiveness of the eye to light just outside of the axis, or fovea centralis, is sometimes explained by the "rods," being more numerous there, crowded out of the central area, as it were, by the less sensitive "cones," so necessary to distinguish colors.

The assumed difference of function of the "rods" and "cones," while largely hypothetical, seems to accord with the facts. In brief the way we see colors is explained as follows: Lights of wave lengths from the lowest red up to the green affect the red sensation most intensely below the orange fading upwards and at last ceasing in the green or thereabouts. The green sensation begins to be feebly affected by waves as low as where the orange joins the red, and its intensity reaches a maximum in the green and fades away beyond the blue. The purple sensation has a similar range beginning in the green, perhaps reaching a maximum towards the violet and fading out in the lavender. It must be remembered that we are here dealing with wave lengths of electric waves that affect these three sensations of the nervous organism of the eye, and not with colors or colored light. The light possesses no color in itself, but depends on the visual organ which receives it and the nervous mechanism back of that for the interpretation of color. Different visual organs and different nervous mechanism will result in different interpretations of these wave lengths.

When we see the yellow in a spectrum, at least two sensations, the red and green, are affected simultaneously and to a certain relative degree; and we interpret the combination as yellow, which is a luminous or bright color (near-white) because two sensations are at the same time about equally and rather strongly affected. With orange the red sensation is affected but the green less so. With yellow-green the reverse is true.

Blue is a luminous or bright color for the same reason that yellow is. The green and purple sensations are affected simultaneously and nearly equally. But the purple sensation is on the whole less strong or intense than the others; and blue of the spectrum, though a light color, is not so near-white in luminosity as the yellow.

May we not be permitted to guess that the purple sensation has been the last to be evolved in the race, since it is more feeble than the others and is believed to be more feeble in some of the more primitive races? The modern processes of color photography are based on the ideas of color vision just pointed out.

MEASUREMENT OF LIGHT AND ILLUM-INATION.

If all eyes were alike in sensitiveness both as regards luminosity and color vision, or if all light sources, or surfaces illuminated thereby produced the same relative effect in all eyes, whether the intensity of such effect was equal or not, the problem of measurement of light would be simpler than it is. Evidently, however, we cannot expect a person who is color blind or partly so, say to red, to evaluate light intensities containing red, in comparison with other tints. sensitiveness of our eyes varies in accordance with conditions. The iris opens or contracts as an automatic diaphragm. The retinal surface in bright light dulls its sensibility automatically, and in feeble light the reverse. This very action, tending to annul too great contrasts, assists us to see into dark corners in the presence of brightly lighted areas. In this respect the eye is far superior to the photographic plate, in which the difficulty is to record any detail in the shadows without extinguishing the high lights by overexposure. On the other hand the photographic plate can be used directly to measure radiation in terms of its action on the plate—a manifest impossibility with the eye. Hence all our light measurements must be based upon comparing lights or surfaces together, one with the other, as by some form of photometer, it being assumed that the observer's vision, though subject to variation, will be affected alike by both lights compared. Practically this results in sufficiently satisfactory values except where the color contrasts are great. In the latter case resort is to be had to special instruments such as spectro-photometers for comparing intensities of the colors in the spectra of the lights con-

If vision or visual power were constant it would be possible to find what proportion of the radiation energy was utilized in producing the light or luminous flux as it has been called. It is indeed hoped that some basis for such a determination may be found. For practical purposes, however, it suffices to establish a suitable unit of intensity of light to which other sources may be compared. The unit which has been adopted in many countries is the "international candle," a standard which has been established by the U.S. Bureau of Standards working in conjunction with similar bodies in other countries. Hence candle-power now means the rating of a light source in "international candles."

The luminous rays emitted by a distant star reach us as parallel rays, and the rays from the sun, on account of its great distance, are substantially parallel. But manifestly the density of the light flux is with the sun enormously greater than in the case of the star. We might find the relative values of these fluxes falling upon a unit of surface normal to its direction, and obtain a figure for the star in terms of the solar light flux or for the sun in terms of the star's flux density. figures would give us the relative intensities of the light sources. But for practical purposes we cannot avail ourselves of parallel rays as in the case noted.

Our ordinary sources of light being

nearby, give out diverging light, generally in all directions. If the source be a luminous point the density will, for a given surface across the path, diminish as the inverse square of the distance from the point emitting light, but the flux for any given solid angle will remain the same. Hence we may establish a unit of luminous flux by assuming a unit solid angle filled with light from a point equal to one standard candle as our basis of comparison. The unit solid angle is the solid radian or steradian, and the unit of light flux so taken is the "lumen." The total light emission of a point equal to one candle, considering the radiation equal in all directions from it, is then equal to 4^{π} lumens, as the surface of a sphere covers 4 π steradians.

Since the practical value of a light source is for illumination, it is useful to possess a measure of the illumination of a surface, such as the light flux which reaches it for each unit of its area. The natural c.g.s. unit would be one lumen per square centimeter. A practical unit of illumination is one lumen per square meter, called the lux. If the square foot be taken it becomes a foot-candle, or an illumination of one lumen per square foot.

In the excellent report of the Committee on Nomenclature and Standards of the Illumianting Engineering Society given at the Niagara Falls convention, September 16-19, a number of proposed definitions, including the quantities and ratios just mentioned, are given, and reference is here made to such report for many additional matters connected with this subject of light measurement and for typical formulae concerning them. Specific luminous intensity of any element of a luminous or illuminated surface is taken as the ratio of the luminous intensity of such element in a normal direction to it, to the area of the element in centimeters. It is expressed in candles per square centimeter. The brightness or apparent specific intensity of any such element of a surface taken from a given position, as in a direction of sight at an angle to the surface, or even normal to it, is its luminous intensity per unit of area of the surface considered as projected on a plane at right angles to the line of sight. The surface included must be small in comparison with

the distance of the observer. The greater the obliquity of the surface to the line of sight the smaller will be its projection or apparent surface in the imaginary plane perpendicular to the line of sight. brightness is measured in candles per square centimenter of the apparent area or surface in the said imaginary plane. The brightness varies inversely with the cosine of the angle of the line of sight from the normal, with such surfaces as those for which the cosine law of emission is found to hold true. When the luminous emission of a surface is expressed in lumens per square centimenter it is designed in the proposals of the report as the specific luminous radiation.

It has been usual to express the reflecting power of a mirror surface in percentage of light returned to that incident on the reflecting surface. The number expressing this percentage as ratio is designated the co-efficient of specular reflection. In like manner the co-efficient of diffuse reflection, or diffusion co-efficient, of a surface is the proportion of the incident light which is returned from it by diffusion.

It may be mentioned that finely ground surfaces, as of glass, for normal incidence of rays will diffusely reflect, while as the angle of incidence is increased or is made more oblique to the surface the reflection becomes more and more specular or mirror like, until at grazing incidences very little light is dffused. Morover, as the specular reflection begins to develop during this change of incident angle, it is the red rays which are most affected, the higher rays continuing to be diffused.

In the report of the committee to which attention is directed, the distinctions between the various practical embodiments of standards of light for use in measurement are succinctly given, such as fundamental luminous standard, primary and secondary luminous standards, reference standard, working standard, comparison lamp, test lamp, etc. The terms are well chosen and of course some are already in use.

There is no need to consider here such terms as mean horizontal candle-power, mean spherical candle-power, mean hemispherical candle-power, which are widely used and understood. *Mean zonal candle-*

power is not so common, but is evidently applicable to certain cases of zonal dis-

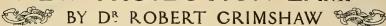
tribution of light emission.

The spherical reduction factor of a lamp is given as the ratio of the mean spherical to the mean horizontal candle-power of the lamp. It is particularly important in the rating of incandescent lamps in which the disposition of the filament sections control the direction of emission. An ordinary candle flame approaches the case of a uniformly radiating source, while a single vertical cylindrical filament would give a mean horizontal

candle-power requiring to be multiplied by the factor $\frac{\pi}{4}$ to obtain the mean spherical power, assuming the cosine law of emission to hold as before referred to.

It will be seen from the above, that if the recommendations of the committee be adopted internationally a great advance will be made in placing light measurement upon a secure and scientific basis. It is indeed singular that this work should have been so long delayed in view of the age of the art and science of artificial illumination.

NEW PROJECTION LAMP



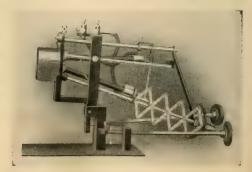
As is well known, the ordinary electric lamp for kinematographic projection utilizes only a portion of the energy of the arc light. The rest of the tension must be overcome by a resistance, which of course effects considerable loss. An ordinary projection lantern works with only 45 volts; and in order to give sharp, clear pictures on the screen, needs about 40 amperes of current. The lamp uses only 40 amperes at 45 volts, or 1,800 watts, of the whole amount 40 X 110 = 4,400 watts paid for. That means a loss of $(4,400 - 1,800) \div 4,400 =$ 56.8 per cent. of the current delivered to the apparatus; or putting it the other way about one must pay for (4,400 -1,800) \div 1,800 = 144.4 per cent. more current than one uses, or 244.4 as much current as one really needs.

Where the line carries 220 volts the loss is still greater, being (220 — 45) ÷ 220 = 79.6 per cent.; or one pays for nearly five times as much electricity as one uses. In fact, in this instance the amount of current to be neutralized by the resistance is so great that every careful "kino" proprietor prefers to put in his own generator, delivering the current

at the required low tension.

The lamp here illustrated is intended to do away with this difficulty, as it uses an arc light of but 70 to 80 volts and 20 amperes, being claimed, however, to pro-

duce as brilliant effects as the ordinary lamp with 45 volts and 40 amperes, the consumption being but $20 \times 80 = 1,600$ watts—the remaining 30 \times 20 = 600 watts being throttled by the resistance and serving to steady the light. This lamp (made by the Regina Elektrizitäts-Gesellschaft of Sulz bei Cöln, Germany) uses in 12 hours with 110 volts, instead of the old 4.4 \times 12 = 52.8 kw., $2.2 \times 12 = 26.4$ kw., which at the end of the year represents a very considerable sum of money. The requisite carbons are not dearer than those for the ordinary arc lamps. The feed of the carbons is automatic, and they cannot be fed ahead at the wrong time and thus cause an unsteady light. The length of the arc is regulatable at will—this being necessary only on starting. The adjustment for height is simple.



EDITORIAL

THE · EDITOR · DOES · NOT · NECESSARILY IDENTIFY · HIMSELF · WITH · THE · OPINIONS EXPRESSED · IN · CONTRIBUTED · ARTICLES PUBLISHED · IN · GOOD · LIGHTING · · · · ·

ILLUMINATION PRIMER

Elsewhere in this issue of GOOD LIGHTING is printed—in full—the Primer on illumination recently developed and published by the Illuminating Engineering Society.

Here is an attempt to indicate some fundamental factors involved in the use of light, so expressed that the layman may at least be caused to think.

The idea behind the work is excellent; the extended, unselfish, laborious efforts attending the work exceedingly commendable, and the attainments are, in a number of instances, meritorious and generally beneficial—but, taken on the whole, the Primer leaves much to be desired.

It is a difficult matter—and more or less a thankless task—to attempt to define—briefly, or, for that matter, extensively—the basis and scope of good lighting, but the effort has been—and *must*—be made.

So many phases are involved, and the use of light—natural and artificial—so varied, that it would seem desirable to either develop a more extended, comprehensive work, or have the present Primer redeveloped, in somewhat similar condensed form, by broad-gauged persons who, at least collectively, have a knowledge of the subject in its entirety.

In the fore part of the Primer, the statement is made that the Society now has about sixteen hundred members who are interested in the subject of lighting from various standards: "engineering, economic, hygienic, aesthetic." Probably this statement, in the main, is correct—and the Society's attitude toward the subject is about reflected by "engineering, economic, hygienic, aesthetic."

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Some phase of lighting other than "engineering" might have been placed first—also in thought—but "engineering" comes first here, and most the same place in all other deliberations of the Society.

Hygiene is of greater importance in lighting considerations, and other factors take precedence over the purely physical as symbolized by "engineering," but such fact is not reflected by the Illuminating Engineering Society's interpretations.

The Illuminating Engineering Society is supposed to consider all aspects of light—both natural and artificial. Does it? When? Where? Certainly not in the Primer. Some vital phases are even not alluded to, much less treated with.

A perusal of the "Chapter" on Artistic Effects will about indicate the extent of the average "illuminating engineer's" knowledge and appreciation of harmonious considerations. With such apparent belittlement of this tremendously important phase, it is little wonder that the Society has been unable to make necessary progress with those interests which are concerned in establishing effects which will not only be pleasing to the eye, but be agreeable to the pocket-book due their productiveness through individuality—advertising—value.

Apparently, in some quarters, it is assumed that aesthetics typify mere excessive embellishment. As a matter of fact, aesthetics ordinarily involve the creation of harmonious conditions—and this applies equally well to the delicatessen shop and iron foundry as it does to the most magnificent public building or the home.

Furthermore, the sometimes underestimated aesthetic has a most important bearing on the revenues of the Public Utilities. While the intelligent application of pleasing effects usually involves a somewhat greater outlay of energy than when commonplace, monotonous conditions are established, yet it is also a fact that those fortunate enough to be the recipients of such applied thought are in most every instance agreeably surprised and very satisfied.

It seems, however, to be a difficult matter for the average "illuminating engineer" to comprehend such fact.

Many psychological factors are of paramount importance in the use of light. This important phase finds no expression in the Primer.

It would seem appropriate to briefly, at least, consider conditions attending the use of *natural* light.

In short, the Primer fails to fill its function, but it does, better

than all criticisms, indicate the "narrow" attitude of the Illuminating Engineering Society towards the broad subject it is supposed to investigate and represent.

The Primer might be taken for a piece of commercial literature.

It is a pity that the wonderful opportunity presented could not the more fully and effectively be embraced.

A Primer might be developed that would first divide the subject into two parts, namely, natural and artificial light. Then subdivide these two principles into the various chief factors entering thereinto, such as physiological, sociological, psychological, aesthetic, engineering, etc., etc.

Further expand the treatment—yet in condensed, simple form—indicating the relation of the various phases to each other, and their bearing on different classes of work. This, in part, could be effectively accomplished diagrammatically.

Express the subject so that when the layman has read the Primer he will, by the very process of its development, be led to analyze conditions when they confront him. In other words, enable the reader to exercise reason, causing him to respect the subject; also appreciate its great "breadth."

The subject of light is a great, *broad*, serious one, though to judge by some treatments accorded it one would hardly suspect such being the fact.

If a Primer were developed on highly intelligent, diversified lines—the contents expressed in a readable, entertaining, understandable manner—the public would be caused to realize that the use of light is worthy of a more extended thought than is usually bestowed upon it.

When the public realize that the proper use of light means so much to them, they will seek knowledge—the present Primer will tend to confuse rather than to assist.

Furthermore, if the subject of light were adequately represented in a properly prepared Primer, it would materially assist in arresting the attention of many important interests not actively identified with the Illuminating Engineering Society, and the opportunity would be immediately afforded for the Society to very considerably extend its effective operations.

There is so much a Primer—though small in size—could contain not found in the one under criticism, that it would appear desir-

able for the Illuminating Engineering Society to take immediate steps to evolve one which would more thoroughly and effectively depict the subject.

ILLUMINATING ENGINEERING SOCIETY

The Editor fully recognizes and appreciates the pioneer, laborious, constructive efforts of the Illuminating Engineering Society; and any one conversant with conditions, or who will attempt a review of such activities, cannot but have great respect for the work undertaken and accomplished by the Society.

So far the advances made through the efforts of the Illuminating Engineering Society have been extensive, though principally confined to but a portion of the field.

The Editor has reason to feel that if all important aspects involved in the subject of light—natural and artificial—would receive due thought—also their relation to and upon each other—that not only would conditions generally be improved in a rapid manner, but the Illuminating Engineering Society—preferably operating under a more logical, effective name—would become many times the power for good it now is.

The Illuminating Engineering Society has done and is doing splendid work, but if somewhat reorganized, and with respect to the subject as a whole, would do even more effective work.

In any event, the Illuminating Engineering Society merits the hearty, liberal support of all interested in the subject of light.

The more workers the more extensive and the better the work.

Inquire of the General Secretary, 29 West Thirty-ninth Street, New York City, as to what the Society has done, is doing, and the bearing of its activities upon you, your work and play.

The story is an interesting one.

Dispatch your inquiry to-day.

PHOTOMETRIC COMMISSION

The effort alluded to in this issue of GOOD LIGHTING to reorganize the International Photometric Commission is an excellent one that merits hearty co-operation of all concerned.

International standards of light should be established—and at the earliest possible moment.

We are happy to know that action to such end is in progress.

The columns of GOOD LIGHTING are placed at the disposal of the members of the Commission, and their associates, to help further this very necessary development.

LEGISLATION

Elsewhere in this issue of GOOD LIGHTING is printed an appeal for assistance in the matter of drafting laws, the exercisement of which will assure improved lighting conditions in factories and workshops.

Here is offered an unusual opportunity to assist in establishing hygienic and economic conditions in a big way.

While great improvements have been effected in lighting accessories and their application, yet comparatively little progress has been made in elevating the standard of their usage as considered by law.

At present the law is "hazy"—to say the least—regarding the correct use of light.

If such condition continues to prevail, it is largely the fault—not of law, but those concerned in the subject of light—natural and artificial.

Let us all tender something suggestive and constructive—no matter how little—to the cause.

Convey your idea now—while you have the subject in mind.

Good lighting laws will not only help improve factory conditions, but will also greatly help the whole subject in its numerous relations.

It is impossible for us to lay too great stress on the great necessity of effecting suitable legislation regarding light.

Don't forget that suggestion.

SOCIETIES

The Illuminating Engineering Society with headquarters in the United Engineering Societies Building, 29 West Thirty-ninth Street, New Yory City, has Sections in the following Cities: Boston, Philadelphia, Pittsburgh, Chicago and New York.

It is customary that in each of these Sections monthly meetings be held, at which time papers dealing with various phases of light are read and discussed. Each of the Sections endeavor to prepare a programme for the season's activity.

Following is published the tentative programmes, to and including February, of the Chicago, New England, Pittsburgh, and New York Sections: These programmes will be amplified and extended from time to time.

CHICAGO SECTION.

December.

"Industrial Lighting." By Ward Harrison, Engr. Dept., National Electric Lamp Association, Cleveland, Ohio.

January.

"Indirect Illumination as Applied to General Offices." By T. H. Aldrich, National X-Ray Reflector Co., Chicago, Ill.

February.

"The Influence of Colored Surroundings Upon the Color of Useful Light." By M. Luckiesh, Physical Laboratory, National Electric Lamp Association, Cleveland, Ohio.

"Some Application of Illuminating Engineering to the Conservation of Eyesight." By F. A. Vaughn, Consulting Engineer, and Dr. Nelson M. Black, Opthalmologist, Milwaukee, Wis.

"Gas Illumination."

Meeting at Milwaukee, in conjunction with the Milwaukee Electric Show.

NEW ENGLAND SECTION.

December.

"Head-Lights, Lighthouses, and Lenses."
By an Inspector of the Un ad States
Government.

January.

"Vision and Defects of Vision."

February.

"The Light of the Stars."

PITTSBURGH SECTION.

December.

"Store Illumination."

January.

"Street Lighting."
By C. E. Stephens.

February.

"Gas Illumination."

Lectures on the elementary phase of the subject of lighting by Prof. H. S. Hower are planned for. The time consumed by these lectures will be approximately fifteen to twenty minutes, some to precede the regular meeting.

NEW YORK SECTION.

December.

Joint Meeting-Arts and Trades Club.

Paper: "Color, Shade and Texture in Lighting."

By George Leland Hunter.

January 9.

Joint meeting with the National Commercial Gas Association.

February 13.

Joint meeting with Municipal Art Society.

PROGRESS

IMPORTANT · ECONOMIES EFFECTED · BY · CLEANING LICHTING · GLASSWARE.

One of the most neglected phases involved in the use of light is that of cleaning lighting equipment, especially glassware.

We hear considerable talk regarding the initial efficiency of various systems of lighting, but, relatively speaking, scant expression, and even less activity regarding their maintenance.

Extensive series of tests conducted under various operating conditions, with both gas and electric units, showed that the acquired depreciation in practise ranges anywhere from 15 to 20 per cent., depending upon the application and attention given to the unit, so that it will be readily seen that if the proper attention is not bestowed upon the factor of cleaning, that an otherwise efficient lighting installation may become quite expensive to operate.

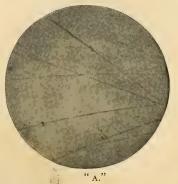
Aside from the economics involved, there is the important aspect of hygiene to be considered.

It is a notable fact that many housewives, who are scrupously clean as regards their general household, will, while cleaning and carefully polishing the cutglass in the dining room, overlook, unless on very special occasions, the lighting fixture with its usual glassware, whereas if the lighting equipment had been cleaned, even greater "life" would have been communicated to the rest of the room, particularly the more or less decorative, as well as utilitarian, glassware so that the sort for brilliancy would be the more fully obtained.

The writer on several occasions has inspected lighting equipment, especially of the indirect type as used in hospitals, and not infrequently has found a not small deposit of just plain garden variety of dirt, plus flies, and other obnoxious matter, and this equipment in wards where unusual care had been exercised in keeping the walls, ceiling, floor, beds, etc., scrupously clean.



CLEANER.

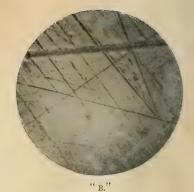


GLAS AFTER CLEANING.

GOOD LIGHTING



CLEANER.



GLASS AFTER CLEANING.

Such condition should not be charged to the lighting equipment, but to the lack of care extended it.

It seems rather odd that so much greater effort should be expended in the cleaning of windows which are for the purpose of emitting natural light that, while not exactly free, is obtainable more readily, usually, than artificial light. This, however, may be due to the fact that dirt on an ordinary window pane can be observed much more readily than on artificial illuminating glassware.

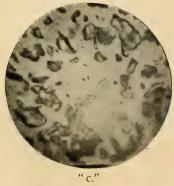
In any event, we know that dirt exists, and sometimes, not unusually, in excessive quantities, to the decided detriment of the operating efficiencies of lighting installations.

The problem, therefore, resolves itself into eliminating the cause.

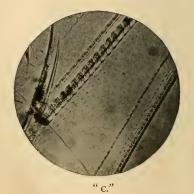
Plain soap and water, if used, would be productive of conditions infinitely better than those which prevail, but, through evolved cleaners the use of which, assure even better results.

Under the present management of Good Lighting, trade names, in the text scientific investigation, there has been proper of the magazine, are usually not employed. In the Progress Department trade names will be used when they refer to some new meritorious development; and we feel that in giving publicity to the Myrlite Globe, Reflector and Window Cleaner, that we are doing the lighting world a even greater favor than we are the manufacturers, for any development calculated to minimize depreciation due to dirt accumulation on lighting equipment is beneficial to all concerned.

We are advised that the aforementioned cleaner, which is the result of careful research and experimentation works quickly, gives a crystal brightness without leaving a dirt collecting film, as in the case of soap cleaners, and in the absence



CLEANER.



GLASS AFTER CLEANING.



" MYRLITE."



" MYRLITE."

of this film delays the period of dirt accumulation considerably, and, therefore, lessens the necessity for frequent cleaning. In other words, the glass remains cleaner much longer.

It is stated that the basis of this compound is an insoluble, neutral carbonate free from silicon, acids, alkalies, and soap compounds, and does not make microscopic scratches on glass, which are accumulative and act as dirt collectors.

Accompanying this article are eight microscopic magnifications showing the effect of well known cleaners on glass, which have been supplied to us by the manufacturer of the compound under review. These are interesting micro-photogravures and tell in an interesting manner conditions not so readily susceptible to word pictures.

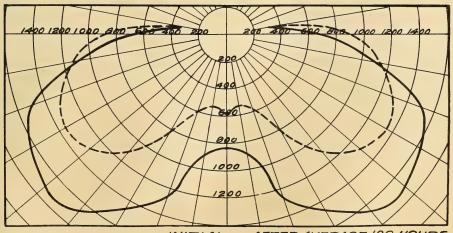
We also show three diagrams which reflect interesting data.

Curve A is a composite curve made by combining the curves of all foreign and domestic flame arc lamps with both foreign and domestic electrodes.

The average acquired depreciation due to deposits on the outside and inside of globes and reflectors, after one burning, which averages about 100 hours, is 24 per cent, ranging in individual units from 18 to 40 per cent. showing the necessity of cleaning at each trim.

Curve B indicates results obtained from a five weeks' test conducted in a The tests embraced large foundry. luminous, flame and mercury arcs. Foot candle measurements on the working plane were made under regular operating conditions. The loss of light, due to

LOSS OF LIGHT DUE TO DEPOSIT ON GLOBES OF ENCLOSED FLAME ARC LAMPS AFTER AN AVERAGE OF 100 HOURS BURNING

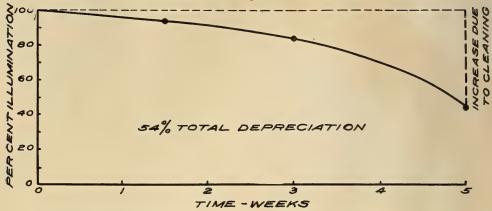


MEAN HEMISPHERICAL CP PER CENT LOSS IN LIGHT

AFTER AVERAGE 100 HOURS

1097 24





DEPRECIATION AND CLEANING CURVE

smoke and vapor deposit for the period mentioned, was about the same for the three systems tested, and the characteristic curve herewith shown indicates that the falling off in light for the last two weeks was approximately double the drop as compared with the preceding three weeks, the critical point occurring at the end of the third week.

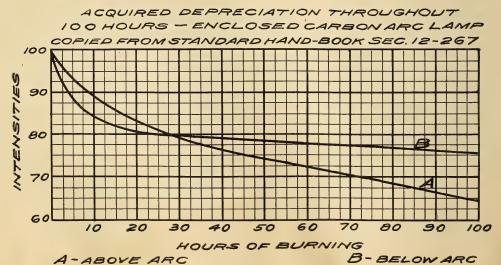
During the tests, the luminous arc and flame lamp globes were wiped out in the usual manner at each trimming, but no attempt was made to clean them thoroughly until the end of the fifth week.

Curve C is taken from the "Standard Handbook of Electrical Engineers" sec-

tion 12, *Illumination*, by Louis Bell, Ph. D., page 946, paragraph 266.

"The loss of light due to the coating formed on the inner globe between successive trims is not negligible, although very variable in amount. Fig. 70 (C) shows a typical result obtained by Mathews from an enclosed arc. The deposit forms more thickly in the upper part of the globe than in the lower, so that A above the arc shows more loss than B below the arc."

"The mean loss of light is 20 to 25 per cent., an amount that must be reckoned with (etc.) in comparing arc lamps with incandescents * * *."



"In the modern flaming and luminous arcs the solid deposit from the arc is an even more serious matter. It is practically carried away by draft spaces provided for the purpose but may still easily cause loss of light fully as great as that just considered if the lamps are neglected."

The report of the National Electric Light Association Committee on Industrial Lighting in May, 1911, contains a contribution from the Illuminating Engineering Department of the Westinghouse Electric & Manufacturing Company. Reference is made therein to the necessity of frequent cleaning of glass and steel reflectors used in connection with tungsten filament lamps in industrial

plants based on extensive practical expirience.

The section under the cleaning system is concluded with the following statement: "It has been found that if the reflectors are not cleaned at fairly short intervals, they will lose as high as 40 per cent. of their reflecting efficiency."

It will, therefore, be readily seen that the systematic scientific cleaning of lighting glassware precludes the possibility of great losses in operating efficiency, consequently, any product through the use of which will enable now present losses to be nullified, is a most acceptable adjunct to the art and science of lighting.

Clean up!

POWERFUL SEARCHLIGHT

The most powerful searchlight ever carried on any merchant ship was a conspicuous feature of the big transatlantic liner Kaiserin Auguste Victoria as she came into the port of New York a few weeks ago. This great light, which is of the largest type ever constructed, was carried on that trip thoroughly to test it out on sea and entering harbors, after which the same type of lamp will be installed on all the big ships of the line. It threw a beam of light of 80,000 candlepower. On approaching port the light was turned on the Scotland Lightship, rendering the name of the ship clearly visible at a distance of several miles. The great light is effective for seven miles

across the open sea and when thrown upon the clouds is clearly visible for a distance of 30 miles.

The searchlight was carried on the bow of the ship on this the trial voyage, but it will later be installed in the lookout, high up on the mainmast where it can be quickly swung to any angle. It is of the type used heretofore only on the largest dreadnaught battleships. The lens is 42 inches in diameter. It is operated on a 110-volt circuit and consumes 13,000 watts or over seventeen horsepower of electrical energy. In actual tests at sea the rays pierced fogs and distinguishable distant objects at every point of the horizon.



The United Gas Improvement Company

Broad and Arch Streets

Philadelphia

LESSEES, OPERATORS AND BUILDERS OF

GAS WORKS

Largest Builders in the World of

Carburetted Water-Gas Plants

Sole American Builders of the

STANDARD DOUBLE SUPERHEATER LOWE WATER-GAS APPARATUS

Total sets installed to Oct. 31, 1912 839 Total daily capacity to Oct. 31, 1912 680,559,000 cu. ft.

Tar Extractors for Carburetted Water Gas. Photometrical Apparatus. Gas Analysis Apparatus. Recording Gauges. Waste Heat Boilers.
First Aid Emergency Kits for Gas Asphyxiation and Electric Shock.
Hygrometers.

Meters for regulating air and steam supply to Water-Gas Apparatus

GOOD LIGHTING And the Illuminating Engineer H.A.Buck Bus Mgr. Robert R.Johnston Adv. Mgr. Volume VII Dec. 1919 Number 10

YOUR ATTENTION, PLEASE!

Account of recent unique, original, practical developments in GOOD LIGHTING, you have been rather led to expect the unusual from this magazine as now constituted. You will not be disappointed.

We have many new and valuable ideas that we are going to give vent to from time to time. In order to relieve the mental pressure, and incidentally, extend constructive co-operation, we are uncorking a "corking" good idea this month.

Note page 537

Albert Jackson Marshall Editor



Courtesy Prest-o-lite Company.

THE ARTIFICIAL LIGHTING OF THE NEW YORK CITY PUBLIC SCHOOLS



In approaching the subject of re-lighting the public schools of New York City in the latter part of 1908, we started off with the assumption, with quite substantial premises, that the lighting systems then employed (five clusters of four 50-watt carbon lamps, each placed at a height of about 7 ft. from the floor) were inadequate and unsatisfactory. They had been laid out with the best results consistent with paraphernalia then available. However, the last few years have witnessed such wonderful improvements in lighting design that the then present effects suffered relatively by comparison.

Before beginning the investigation the writer collected all available lighting equipment—i. e., lamps and reflectors—that seemed to offer a solution of the problem. From each lamp and its reflector a photometric curve was obtained and its probable effect on illumination results

studied.

When the lighting units had been carefully sorted and studied, those that seemed to assure the best results were used in conducting a series of tests to determine illumination values obtained on desk level of

a typical schoolroom.

A number of wires were stretched horizontally from wall to wall in the room under test, and from these wires a number of various types of units were placed and illumination readings made. arrangement of equipment permitted movement of units to any point either in vertical or horizontal planes in the room. Such arrangement, together with various types and sizes of lighting units, permitted the attainment of various intensities and distribution of illuminating effects. These tests were made after sundown and were conducted over a period of a number of weeks.

From our tests we arrived at the conclusion that nine units placed in an asymmetrical location were best for our purpose.

Fixtures consisting of a stem supporting deep bowl, dense opal reflector, with depolished inner (reflecting) surface, and 100-watt bowl, frosted, metallized filament lamp, the bottom of which comes to a point 9 ft. above the floor, were so arranged that the greater amount of the light came from a point a little to the left and forward of the students' desks. In that way whatever shadow was created was delivered in a direction such as to be received under the pupil's hand in writing, there being an absence of shadow forward of the pencil which would tend to confuse.

The effective average illumination obtained at the time of the tests with new

equipment was 3.20.

After we determined to our satisfaction the location and height of the indicated equipment, we courted expressions of opinion from the principal of the school, teachers, and pupils, also the Committee on Buildings of the Board of Education and the Superintendent of School Buildings, all of whom visited the building in which tests were conducted, and after careful observation of the system formerly employed and that recommended, and herewith referred to, were unanimous in the opinion that the new system was far superior in every respect to the old style. The opinions were singularly free from criticism.

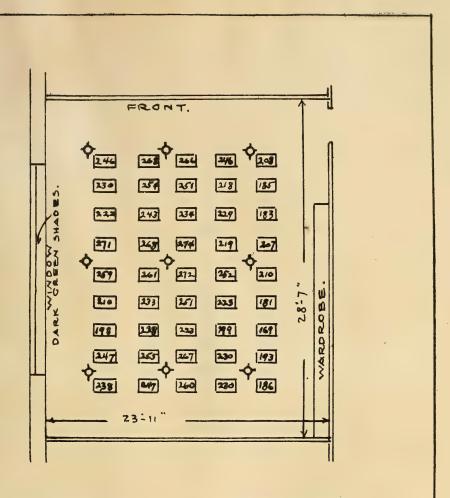
Another test of a practical nature was conducted to ascertain the value of the new system and was as follows: Only one room in the building in which the test was conducted was equipped with the modern type of illumination, and classes from other parts of the building were brought into this room and allowed to stay for the period of one evening's session. After all of the classes in the building had been permitted to spend a session in the room



OLD ARRANGEMENT AND EQUIPMENT.



NEW ARRANGEMENT AND EQUIPMENT.



P.S.101. BORO. OF MAN, CLASS RM .408.

HEIGHT OF STATION ABOVE FLOOR. 3-0"
LAMPS. 100 WATT METTALLIZED FROSTED BOWL "8, VOLTS.
GLASSWARE. DEEP BOWL DENSE OPAL, DEPOLISHED REFLECTING
SURFACE.
HEIGHT TO BOTTOM OF REFLECTOR ABOVE FLOOR. 9-0"
DATE. JAN, 5TH 1912.

SCALE. 1/2 IN. = 1 FT.

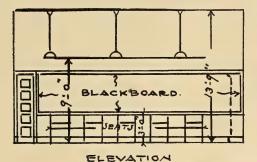
OUTLETS, AS PER PLAN. VOLTAGE 119.6

AREA. SQ.FT. 684. HEIGHT OF CEILING. 13-9"
WATTS PER SO FT 1.32 FINISH OF CEILING. BUFF.
ENISH OF WALLS, PEA GREEN TO 1-6"FROM FLOOR THEN BUFF TO
CEILING. AVERAGE FT. CANDLES, 2,32

PLAN OF ROOM, SHOWING LIGHTING VALUES AND OTHER DATA.

in which the new lighting equipment was installed, a vote was taken to ascertain whether in the pupil's mind the modern illumination was superior to that under which they had been previously working. The opinion was again unanimous in favor of the new equipment.

Owing to the nature of the glassware and the bowl frosted lamps employed, to-



gether with the height of such units above the plane of illumination, the glare factor formerly so conspicuous has been reduced almost to a minimum.

TOWARD

NEW STYLE LIGHTING.

LOOKING

FRONT

As has been stated, the average footcandle intensity obtained from this nineoutlet arrangement when all the equipment was new and clean was 3.2.

After this type of equipment had been in use about one year, the original lamps still being used, the equipment was again tested, showing a depreciation of about 42 per cent. Similar tests were conducted in other rooms similarly equipped, where the depreciation ran about 20 per cent., which may be considered as more nearly what we would get in average practise. During the year in which this equipment was used it had been not too carefully cleaned, and when the tests to determine depreciation were conducted there was a thin film of dust over lamps and reflectors.

The nine-outlet arrangement just described is standard, and consequently is being employed in all buildings subject to remodeling and all buildings being constructed or to be erected.

There are a number of buildings in which it was deemed impractical to change from the old five to the new nine-light system. However, certain improve-

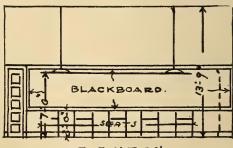
ments in the nature of fixtures, glassware and lamps were effected.

In the accompanying photograph it will be noticed that in the old equipment a special metal reflector with clear carbon lamps was used. This equipment was disposed of and in its place was installed a short-stem fixture carrying a frosted prismatic reflector and a 187-watt metallized filament lamp, the bottom of the reflector coming to a point 10 ft. 6 in. above the floor.

The principal foot candle intensities obtained from the 5-light system as above described, is as follows:

	4.15 foot candles.
Average .	3.44 foot candles.

These values, as well as others indicated in this article, are shown on one of the accompanying plates, have not been corrected for voltage fluctuations, the tests being conducted with electrical pressure as found. It might be said, in fairness to the results, that the voltage on the above test was about 1.5 per cent. above normal, which would similarly affect stated foot candle values. It is fair, however, to assume that average foot candle intensity under working conditions, ac-



LOOKING TOWARD FROMT OLD STYLE LIGHTING.

counting for dust and lamp depreciation is upwards of 2.5.

At present the metallized filament lamps are employed for the following reason: In the city of New York, the Department of Water Supply, Gas and Electricity are in control of the lamp situation, that is to say, that department designates the character of lamps that shall be used by the various city departments. Inasmuch

as the contract which the city has with the New York Edison Company carries with it a supply of metallized filament lamps, without extra charge, the Department of Water Supply, Gas and Electricity have not considered it advisable to authorize the extra expense that would be involved in the use of tungsten lamps. However, when the tungsten lamp is available, same may be employed in the present equipment with substantially the same results as is at present obtained, this being actually demonstrated by a series of tests.

The photographs, plan of school room, and elevation sections accompanying this article carry general and specific information which will give an ample idea of the arrangement and character of equipment, and results obtained.

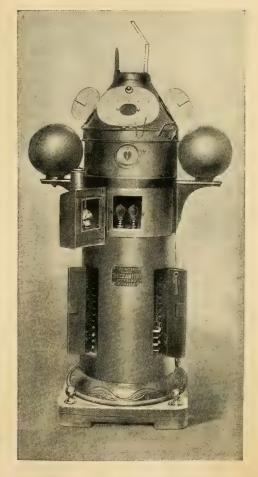
A Combination Electric & Oil Lighted Binnacle By Frank C. Perkins

In order to be always sure of a well lighted binnacle, the instrument shown in the illustration as designed and constructed at the Hezzanith Observatory work at Crayford, England, has both electric light and oil lamps beneath compass.

These instruments with 6-in., 8-in., 10-in. and 12-in. compasses are fitted with adjustable lateral helical beam spring suspensions mounted with the adjustable laminated bowed-blade damper springs, giving adjustments for accurately setting the lubber line and also for meeting the vibratory conditions of different ships.

It is stated that the oil lamps are so arranged that no smoke passes into binnacle which has convenient and complete sighting arrangements. The electric lighting is most accessibly fitted and regulated, and the instrument has a rigid ring Thomson compass card and a controlling switch to reduce light for taking night bearings.

A rigid-ring card of the Thomson pattern is used to advantage. At first there seems nothing very complex about light compass cards; a combination of silk, paper and aluminum, with a few magnetic needles appears to require little thought in design or skill in manufacture. However, the task is a difficult one—but the problem has been solved.



·ILLUMIT AT INC-BODIES AND · ·LAMPS · FROM · OLDEN · TIMES :

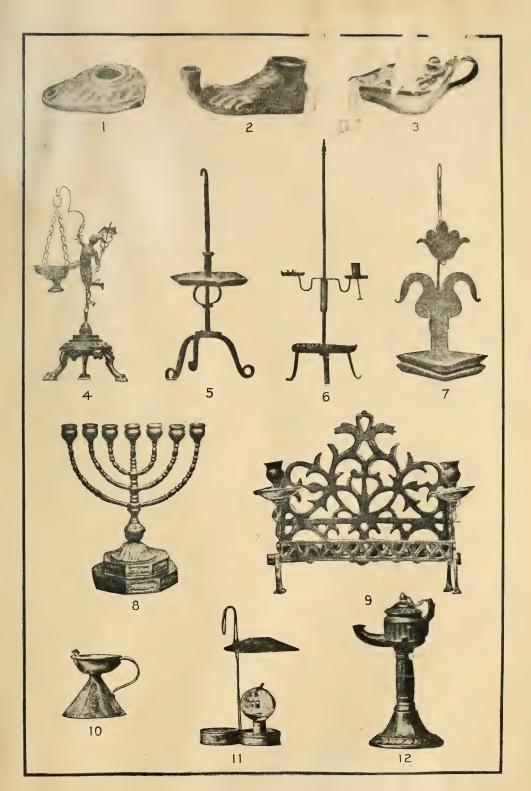


The lamp and luster manufactory of Kretzschmar, Boesenberg & Co., at Dresden, founded in 1868, is in possession of an extremely comprehensive collection of illuminating bodies and lamps from former times; gathered and put together through years of laborious work and at considerable expense. This noted collection was first shown to the public by the said firm on the occasion of the International Hygienic Exhibition at Dresden in 1911; furthermore, at the Electrotechnical Exhibition for Domestic, Commercial and Agricultural Purposes at Leipsic in 1912, at the "Erzgebirge"-Exhibition held at Freiberg, Saxony, and at the International Gas Exhibition at Amsterdam. It is the chief aim of the said firm, whose partner, Mr. Alfred Boesenberg, is at the present time preparing an extensive treatise on ancient or former illuminating devices, not only to possess a collection of their own, but also to encourage museums to effect a completion and enlargement of their generally rather scanty stock in oldtime illuminating bodies, but also to cause private collectors to undertake bringing together collections of illuminating bodies and lamps. In fact, there is hardly any other article that merits to such an extent the interest of wider circles of society; for the ancient illuminating utensils offer extremely numerous attractions for the antiquarian and archæologist as well as from a hygienic point of view and in relation to culture and applied art. It is only within the last three decades that gas, incandescent and electric light have been to such an extent improved as to render possible their domineering position in the illuminating industry of our days. Not even a single generation has passed since the time

when neither gas, incandescent light, nor electric light, nor illumination by means of petroleum was known. Behold the formidable revolutions that have been accomplished in this short time in the field of illuminating appliances. Nowadays, in the time of the gas and overland centrals, extending over the plains into the smallest villages and hamlets, it not unfrequently happens that the inhabitants of houses, into which not even the kerosene lamp has penetrated, experience a sudden transition from lighting modes of the most primitive kind, such as the tallow or oil lamp, the candle, nay the burning chip, to the most perfect illuminating means-viz., the electric metal thread lamp. It would by no means be out of place to designate the twentieth century as the Century of Light, the same as we speak of the iron and bronze ages.

Such a remarkable turning point in the illuminating industry is apt to lead us to a retrospection, to those modes of lighting that were in use at the time of our early ancestors; at the same time it imposes on us the duty of collecting the lighting utensils and appliances that were employed by former generations. In the following we present an epitome of the book that is being prepared by Mr. Boesenberg at Dresden and contains 700 illustrations.

An enumeration of the single lighting utensils, chronologically and precisely in conformity with the time of their application, is impossible, for in the same manner as in our days the electric, gas-acetylene, spirit and petroleum lights effect our lighting concurrently in peaceful competition, in former times burning chip, tallow, oil and candle have competed as lighting appliances or means.



As early as in the times of the ancient Egyptians and Greeks there were lamps in use. The antique lamps made of clay or bronze, of which specimens have come down to us, belong to the times of the ancient Romans. In the accompanying illustrations, Nos. 1 and 2 are made from burnt clay, No. 1 being oval in shape while No. 2 is in the shape of the human foot. No. 3 is made from bronze and has a handle. These lamps, which served for lighting the house, were also buried with the dead as a symbol of life or as an emblem of the immortality of the soul. The first Christians, though desirous to keep aloof from the heathen usages, likewise lighted lamps at interments, which, however, were provided with Christian emblems, such as cross, lamb, the monogram of Christ. No. 4 (according to excavations at Pompeii) is a lamp carrier made of bronze representing Mercury, with a small oil lamp suspended from chains.

Such lighting objects as are depicted by Homer in the Odyssey have hardly come down to posterity. Dead shrubs or wood mixed with pine chips in fire vessels served for lighting; furthermore, "the shine from the brilliantly glowing torches borne in the hands of golden juvenile figures."

Nos. 5, 6 and 7 are tallow lamps. For the purpose of attaining a better illuminating power, the tallow used to be mixed with verdigris sometimes, or partly also with sand, in order to obviate through the latter the burning of the entire surface of

the burning material.

Into the tallow contained in the cups or shells the wick was placed. Nos. 5 and 6 are adapted to be raised and lowered and kept at a desired height by means of a spring suspended from the rod or stem. No. 6 is fitted simultaneously for use as a tallow lamp or as a candle. No. 7 is made to be attached to the wall; the second shell provided at the frame proper apparently merely served for catching up the heated and liquefied fat when running over; the upper shell, which is the burning vessel proper, is adapted to be detached.

No. 8 represents the reproduction—though here provided with candles—of a septempartite luster with oil lamps which is described by Moses. This lamp burned during Jewish worship in the sanctum of

the tabernacle and of the temple. The seven oil lamps fitted on the luster-like frame had the oval shape of the almond and were adapted to be taken off when being prepared by the priest; three were kept burning in the day time, while during the night all seven were alight; they were fed with the finest olive oil. The lustre, which was a hundredweight in weight and reputed to be worth about \$11,000, is said to have been robbed by Titus in the destruction of Jerusalem and taken in triumph to Rome; there is a relief-like representation of this lustre at the Arch of Titus at Rome.

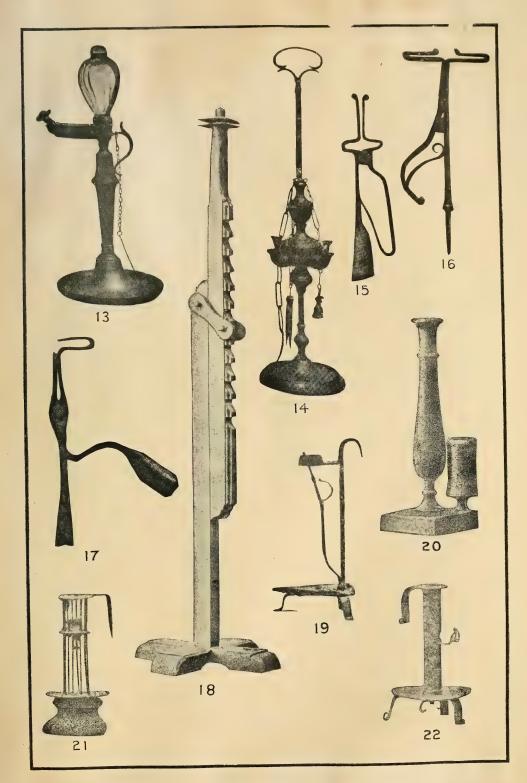
No. 9 is a "Chanucka" lamp with eight little lamps for linseed oil and two lateral nozzles for candles, which served for lighting the linseed oil lamps. This lamp, which is still in our days used by orthodox Jews for linseed oil or only for candle lighting, must be referred to in connection with the famous Temple lamp illustrated by Fig. 8. Of these lamps, on the occasion of the feast of the consecration of the temple (Chanucka), one is lighted on the first day and subsequently one more each eight days. In most cases the lamps were made from bronze, more

rarely from silver or tin.

Nos. 10, 11 and 12 are oil and tallow lamps of German origin. For tallow the lamps are mostly open; for oil, however, they were always provided with a cover. This lamp occurred in the most manifold forms - in the time between 1700 and 1850—also, according to the kind, in the shape of the oil or train-oil lamp, oil-"kreisel," or as hanging-lamp oil "kruesel" by name; from the shape of the oil reservoir, this lamp was called cat's head and egg lamp; also the material was manifold; above all, tin was used, then copper, brass, white metal, burnt clay (called "lichtscherben"), glass, porcelain, stone and pottery. No. 10 is a tallow lamp made from tin; No. 11 is an oil lamp (socalled weaver's lamp, for lighting the loom), with wooden base, wire bow, vertically adjustable tin shade, glass receptacle adapted to be inserted and having a white metal nozzle for the wick.

No. 12 represents a "Siegborg" rockoil lamp, about 1600.

No. 13 is an oil lamp made from tin



(time 1 mp). The oil reservor from glass in the shape of a pear was stuffed at the outlet with oakum, in order that the oil should penetrate to the wick only dropwise. Along the pear-shaped glass there is in the form of a band a tin strip with numbers—in most cases from 7 to 12 and from 1 to 6. The lamp was kept burning the whole night, and according to the consumption of oil the right time could be ascertained from the hour scale.

No. 14 illustrates an Italian or Venetian lamp for olive oil—time eighteenthnineteenth century—with pincers suspended from chains, snuffer and extinguisher. The body of the lamp is made either in one, two, three or four parts and is adapted to be vertically displaced at the stem

or bar by means of a spring.

The pine chip lighting mode was very extended geographically, as well as in regard to the length of time it was in vogue -namely, from 1500 till 1860-it was the general lighting means on farms and peasants' cottages in connection with the holder for the pine chips as illustrated. But long before 1500 the pine chip served for lighting purposes. It used to be introduced in casual crevices in the walls or into iron rings provided for the purpose in walls. As may be seen from old pictures, it was also held in the mouth in a burning state by people doing work in house and stable. At the time of Charlemagne the smoking pine chip was the means of illuminating the festive halls of castles and fastnesses. In thin, small pieces the chips were burned either placed in layers on iron, scale-shell like gratings (pine lighter), which latter were suspended from chains, or in iron baskets. In the winter months the chips of pine wood were made by servants by means of cleaving, slicing or planing with specially arranged pine chip planes served by four men; they were made in pieces of about one meter in length and five centimeters in width.

In the lamps represented by Figs. 15 and 16, the chip was held by means of spring power; No. 15 was placed upon a wooden staff, while No. 16 was fastened or knocked into the wood of the table, working bench or stove bench. With the lamp No. 17, the chip was held fast by the force of the iron weight laterally provided

at one of the levers. No. 18 shows an iron pine chip holder, placed upon a wooden base, which is vertically adjustable by means of a rack bar. The length of the frame in the drawn-in state is 1.10 meters, and when drawn out 1.30 meters. For the purpose of keeping the flame of the pine chip continuously in operation in a proper manner and catching the falling-down glowing or burning particles of wood, the attendance of a special person was needed.

Candle stands, wall, hand and hanging lustres or lights are represented in all imaginable forms and kinds of style, this variegated character of these appliances having its reason in the manifold use of the same in churches, castles, fastnesses and citizens' habitations, and in their application during thousands of years with

tallow, stearin, or wax candle.

Lamp No. 19 is iron-forged; the candle was held by the aid of a spring; this appliance was officially prohibited because of the fire danger involved in the falling down of the last burning stump of the candle. No. 20 is made of wood with a lateral receptacle for spills. Lamp No. 21 is of iron with wooden base, the so-called cellar light; the candle nozzle is vertically adjustable by sliding at the iron bars. No. 22 is an iron-forged hand light, No. 23 one of cast brass, No. 24 is of tin in rococo style.

In former times, almost in every large household the candles were poured from tallow, fat and similar substances. No. 25 illustrates a candle mold in six parts made

from sheet zinc.

Snufflers occurred in iron, brass or bronze, German silver or steel; the plates belonging thereto were made (also called cups) out of the same metals in oval shape, also in tin lacquered, in glass, in copper, silver plated, and in silver. No. 26 is shown in simple workmanship, while No. 27 is provided with a movable protecting side, which lifts itself out automatically when the snufflers are opened and sinks down again after the wick has been trimmed, in order to obviate the falling of the wick crust from out of the casing, thereby preventing at the same time fire danger and bad smell.

No. 29 is a wooden frame with vertical-



ly adjustable light shade. The plate is made from translucent china—Lithophany—manufactured by the Royal Porcelain Manufactories at Mcissen, Berlin and Plauen. The representation embodies Faust and Marguerite, with Mephistopheles in the background.

No. 30 represents wax taper snufflers made of forged iron. These were also in many cases made from brass. They hold the upper part of the wax taper; this part being adapted to be screwed off for the purpose of receiving the taper.

No. 31 represents a china specimen of a box or receptacle for wax tapers. After lifting the lid, the tapers are kept in these boxes. No. 32 is made from pierced brass. In the wax taper holder, No. 33, that is silver plated, the wax taper is arranged to lie horizontally.

Nos. 34, 35 and 36 are coal pit and mining lamps. No. 34 is a wooden casing laid out on the inside with sheet zinc or brass; this casing receives the linseed oil lamp of brass which is provided at the base with a nozzle. This lamp was worn by the miner during work on the chest, fastened into his frock or blouse.

No. 35 shows a mining lan

No. 35 shows a mining lamp, called—in accordance with its shape—a frog lamp, and used in a similar form also in the household as an oil and tallow lamp. This mining lamp used to be hung up in the mine at the place of work and was also used by the miner fixing it to his cap. These lamps were manufactured from iron or sheet brass, in forged iron or in cast iron; they carry engraved on a metal check or mark in most cases the emblem of mining-viz, two hammers crossed and the miner's greeting, "Glueckauf." The lamps 34 and 35 are still used in our days in ore mines; they were formerly also employed in coal mines, where they are now entirely abolished on account of the danger involved in their use, having been replaced by No. 36, the Davy safety lamp, fed with benzine, the construction of which has been continuously improved The principle embodied in this lamp is that it is arranged to be automatically extinguished in cases of fire or choke damps; furthermore, it can be opened for the purpose of filling only in the lamp room, but not by the miner in the pit, while the ignition is effected mechanically from the outside.

All of the oil lamps heretofore described that have been in vogue during thousands of years, possessed a round, full wick, make of oakum or of the marrow of rushes; or they were twisted together from single cotton threads (the socalled lamp yarn). It was not before the year 1780 that an essential improvement in oil lamps was achieved by the invention of the oil lamp with double air draft, in connection with the glass tube or cylinder invented a few years after by the watchmaker's son, Argand, in Geneva, born in 1756, and by the apothecary Quinquet, a Frenchman, who was the latter's competitor in his invention. The first of these Franconian or Argand lamps, Nos. 37 and 38, with flat lateral oil reservoir, burned without a cylinder. Subsequently they were furnished with straight cylinders from sheet metal at first, but later from glass, which were provided by means of lateral holders, a little above the flame, and still later glass cylinders with crease. which, being placed direct on the crown of the burner, completely surrounded the flame. The wick was at first flat and was moved through a directly gearing toothed wheel; afterward the flat wick was made semi-circular by being guided in a sheet metal sheath, and at length it was made round in the shape of a tubular wick and moved by means of a rack bar or worm gear, as in lamps Nos. 37 and 38. These lamps are made from sheet metal and japanned; No. 37 has also a japanned sheet metal shade, while No. 38 is provided with a shade from milk glass. No. 39 is a German slide lamp made after the Paris model. It is executed in brass with a shade from opalescent glass; the lamp, together with the oil reservoir being vertically adjustable at the brass rod. pear-shaped oil reservoir is provided at the bottom end with a valve, whereby a completely uniform level of the lighting material and thus a quiet flame are attained. The tendency to dispense with the oil reservoir at the side of the lamp so as to do away with the shadow thrown by the reservoir induced the two Frenchmen, Philipps and Bordier-Marut, and the Englishman, Parkers, to invent the Sinum-



bra (without shade) and the Astral lamp. In this lamp, shown by No. 40, the oil reservoir is arranged coronarily around the burner, serving at the same time as carrier or support for the shade. These lamps were in some cases adorned quite luxuriously, and, thanks to their slender form and the slight prominence of the oil reservoir, made a very pleasing impression. But also these Sinumbra lamps lighted only the surface of the table without throwing shadow. With the aim to remove the lateral shadow caused by the oil reservoir being arranged above the burner, the Paris watchmaker Guilleaume Carcel, born in 1750, invented in 1800 the development and application of the foot of the lamp as an oil reservoir. As may be seen from the cut-out at the base of Fig. 41, Carcel used in the Carcel lamp bearing his name—also called clock-lamp—a clock work, which actuated a pressure pump; the oil was driven by means of the latter from the base of the lamp into the burner. The patent for this expensive construction was valid until 1816. In the year 1836, Franchot, of Paris, invented the Regulator, or Moderator, lamp, No. 42, thereby presenting a considerably cheaper construction. In this lamp the oil is contained in a cylindrical space; on the oil presses a piston with leather stump, which is depressed by a spring receiving tension by being wound up. By means of the spring, in connection with a toothed bar, the piston is wound upwardly, whereby the oil that was previously over the piston is moved under the piston by the aid of a valve. Now the piston, which is being pressed down by a strong spiral spring, rests on the oil, pressing the same through a valve slowly and gradually to the burn-

The Carcel, or Moderator, lamps referred to had, in comparison with the former oil lamps, the further great advantage that they burned a long time—seven or eight hours—and excellently without refilling; moreover, by placing the weight centrally into the base developed as oil reservoir, they were given a firm and secure stand. Moderator oil lamps have been burned up to the end of the nineteenth century, on the one hand owing to the great favor in which they stood with the public on the other presumably in view of the frequent explosions occurring with the petroleum lamps, during the first years of their introduction, through deficient refining of this material. The first petroleum lamp is said to have been constructed by Silliman in North America in the year 1855. The firm of C. Beutenmueller & Co.—which is still in existence —has had the meritorious privilege of being the first to introduce petroleum and petroleum lamps from America into Europe (in the same year in which the firm was established—viz., 1862).

Domestic lighting comprises, moreover, the lantern to be carried about in the house, in the yard, and in stables; it has likewise been subjected in the course of time to manifold changes in regard to shape, material and mode of lighting. Nos. 43 and 44 represent two domestic lanterns, presumably at the same time drivers' lanterns, used at a time when gas was not yet employed for such purposes. Both are made of sheet metal for illumination by candles. Lamp No. 43 gave the light through slots punched in and distributed over the entire sheet metal casing. Lamp No. 44 is provided with disks or panes made from pigskin.

LIGHT FOR MEMORANDUM PAD

It is well known that many writers keep a pencil and pad at hand to copy a choice sentence, an expression or a word that is called to mind, knowing that to let it pass may mean inability to recall it.

To some this peculiarity is strongest

just after retiring, and this fact has led Otto Knoerzer and Joseph W. Weis, of Hammond, Ind., to patent a small battery and lamp to which is attached a memorandum pad. The pad is held in place by a spring, while a lamp is arranged to illuminate the leaf.

ARCHITECTURE & ——— "ILLUMINATING ENGINEERING"

Some views expressed by Mr. Frank E. Wallis, Architect, New York, for publication in The Illuminating Engineer, London, during his visit to that city.

The profession of the architect is a very old one. Illuminating engineering, on the other hand, is amongst the youngest of professions. A few suggestions from one who, while connected primarily with architecture, has also had opportunities of appreciating the value and scope of illuminating engineering may therefore be of interest.

There are certain problems, such as the lighting of offices and factories, in which the object of the light provided is purely utilitarian, and where the illuminating engineer has much good work to do in providing efficient and serviceable conditions of illumination.

But there are higher fields for his activity in connection with the lighting of buildings of distinction, where aesthetic and architectural considerations must prevail. At the present moment it may be said quite frankly that in such work the architectural profession has little use for the illuminating engineer. But this should not be so. The illuminating engineer might be of real service if he understood something of the architect's work and the conditions with which he has to deal. There are many instances in which the illuminating engineer will never carry his point so long as he thinks only of efficiency. He should know something of the history of architecture, and the meaning of the traditions by which the architect is guided. He should understand how to adapt a method of lighting so as to be in harmony with the style of a room, its furniture, and the general scheme of decoration. He should appreciate the fact that the light provided must not only serve to illuminate the table, but to reveal panels, moulding, ornament, and color. If the illuminating engineer will study these things, his knowledge of the technical possibilities of the various illuminants, of shades and reflectors, etc., should be of great value. I venture to suggest, therefore, that, in the courses of instruction devised for lighting engineers in the near future the study of architecture should play a not inconsiderable part.

In the same way, it may be conceded that some architects do not appreciate sufficiently the aims of illuminating engineering, and it would be well for them, too, to receive more information about illumination, provided this information is presented in a suitable form. There are many instances in which the combined efforts of the architect and the lighting engineer would lead to great results, and for the higher branches of lighting work some form of fusion between the professions seems to be necessary.

I wish your Society the success it deserves in its noble and elevating aims, and I hope that it will be instrumental in bringing about closer co-operation.



Please-

The statement on the opposite page merits your attention—and thought.

Thank you!

"Our suggestion is—"

Not "That isn't right!" or, in substance, ou don't know your business!"

"Our suggestion is—," is the Good Lighting way.

"That isn't right!" or "You don't know your business!" is the usual attitude of the average "illuminating engineer," the exception proving the rule.

The Good Lighting way is intelligently and co-operatively constructive.

The other undesirable way is destructive and antagonistic.

Good Lighting has full respect for and knowledge of the sought for realistic ideals of the Architect and others interested in the subject of light.

Not only are the effects desired appreciated, and the means understood, but, furthermore, Good Lighting is in a position to *indicate effects heretofore not attempted*, much less obtained, the development of which will greatly enhance the value of lighting and associations.

Good Lighting, therefore, offers to the Architect, and others responsible for Lighting development, its augmented corps of lighting specialists, to broadly and constructively advise at nominal cost, on any and all phases involved in the use of light—natural and artificial.

These lighting specialists are in every sense of the word absolutely independent of any and all commercial or extraneous affiliations which would tend to bias or otherwise affect their deliberations and recommendations.

THESE SPECIALISTS KNOW AND ADMINISTER TO THE SUBJECT IN ITS FULL ENTIRETY

The exercisement of this unprecedented offer will revolutionize the lighting industry, and assure a development in keeping with practical idealistic conditions.

Particulars of this original offer are as it eresting as they are valuable.

CORRECT LIGHTING INCREASES SALES

BY FD. PEMBLETON

Regardless of political beliefs and personal opinions, it must be acknowledged as a fact that when Theodore Roosevelt's story of his African hunt was published in Scribner's, the sales of that magazine increased three hundred per cent. When he returned from the jungle, he was enter-

All because of his wonderful personality.

And so it is in business.

Every business, or store, has a distinct personality,

—Or, rather, every store is the expres-



tained by royalty and the greatest men in Europe.

Upon his return to this country, he was given the greatest reception ever accorded an American citizen.

And recently we have seen him form a new political party under his leadership and send the grand old Republican party down to defeat. sion of the personality that controls its policies and directs its sales plans.

This personality is expressed in everything pertaining to the store: the construction of the show windows—the window displays—the equipment and arrangement of the interior—the goods offered for sale—the type and manner of the salespeople—and the service rendered the customers.

The strength of the personality so expressed and the degree to which it approaches perfect development, measures the degree of success to which the store will attain.

So, we have in the business world various expressions of personal force and various degrees of commercial success, ranging from the great houses of Field and Wanamaker to the little unattractive shop that hangs on in spite of mismanagement,

Just because it is, at times, a convenience to a limited number of patrons.

By determining the character and personality that he desires his store to represent.

—And by making his store express that personality,

—A merchant can predetermine his class of customers and the degree of his success.

—Whether he will be a merchant prince,

-Or, just a little storekeeper.

The master minds of the commercial world have long since recognized these principles,

—And have spent thousands of dollars to provide their patrons with a store almost perfect in its elegance, equipment, convenience and service,

—A store that interests and attracts customers.

—And where shopping is a pleasure.

But the small merchants have, perhaps, had to work with a limited capital.

To meet the competition of the department stores they have probably given most of their attention to goods and prices.

However, it is a fact that the great majority of small merchants have neglected the features that give their respective stores a distinctive personality,

—One that makes a positive appeal to the particular class of customers that they want to reach.

There is usually not more than two or three such stores in each of the smaller cities throughout the country.

A casual inspection of the stores in most any city will prove this statement.

The time has arrived when small merchants can no longer afford to neglect this phase of their business.

This is an age of specialists.

While the department store seeks to provide for the shopper economy of time and effort,

—The owner of a specialty shop, by concentrating all his knowledge, energies and resources on his particular line, can provide his customers with a highly specialized service that will appeal to particular people.

His constant window displays and advertising can be given greater prominence than the department stores usually give to any one department.

Every phase of his business can be made to express the powerful influence of his individuality,

—And to every sale can be given a degree of personal consideration that appeals to the customer and holds his trade.

One will need to travel a long way to find a more highly developed speciality

—Or, a store that more perfectly expresses a strong, distinctive personality than does the French Shop in Newark, N. J. owned and managed by Mr. N. L. Kahn.

The exterior and interior of this attractive store is everything that the name suggests.

The line carried is high-grade, exclusive

gowns, suits and accessories.

The qualities are such as appeal to the woman of discriminating tastes who demands exclusive designs.

The prices are very much lower than those asked for the same quality of goods

in the Fifth Avenue shops.

From the well-designed sign over the door and the evergreen hedge along the outside of the windows to the specially designed boxes in which the goods are delivered, everything about the store strongly expresses refinement, good taste, individuality,

—And inspires confidence that the goods offered are correct in form.

The exterior of the building is gray brick. The window frames are finished in grass green. The interior trim, show cases and furniture is oak finished in French gray. The floor is gray concrete covered with heavy rugs in plain old blue. The color scheme of French gray and old blue is maintained in all of the stationery



cards and announcements. The sales force is composed of bright, refined young women, who are capable of dealing intelligently and tactfully with the class of customer that patronizes this shop.

One of the most important features of the store is the lighting equipment. The fixtures are clusters, or showers, suspended by chains. This type of fixture, finished in dull silver, harmonizes with the decorations.

The even spacing between the fixtures

The manager of a store on Forty-second Street, New York City, covered the entire ceiling of the show windows with 100-watt tungsten lamps equipped with focusing reflectors.

Then, he removed all of the goods from the windows and placed men behind screens in the rear of the store to count the number of people who stopped to look at the windows. He wanted to test the attractive power of light.

By actual count, no one passed the win-



and the height at which they are placed produces an even distribution of illumination. The uniform intensity of the light and the absence of shadows brings out the detail and enhances the beauty of the furnishings.

The general effect is that of a distinctive and unusually attractive store so brightly lighted that customers can clearly see the color and quality of the goods.

From the store, as a whole, there emanates a subtle, but powerful appeal to the woman who is fond of refined, exclusive apparel.

dows without looking at them and during the early part of the evening there were from three to five people standing in front of the windows, wondering at the intensity of the light.

If light alone will attract attention in the heart of the Great White Way, it is not hard to estimate the attractive power, in smaller cities, of brilliant illumination combined with well-arranged displays.

If properly illuminated, the decorations and displays in show windows and stores are more attractive at night than they are during the day, —Because artificial illumination can be arranged so as to give a correct blending of lights and shadows, making the elegance of the decorations more pronounced, emphasizing the display and producing artistic effects that cannot be obtained without artificial light.

The average store is so constructed that a high intensity of day-light will not penetrate to the rear of the store. Therefore, the attractiveness of its equipment and display is greatly reduced during the greater part of the day, unless artificial light is used.

wide-awake merchants are beginning to realize that correct lighting is essential to maximum sales, and the time is not far distant when stores will be artificially lighted all day.

No merchant need have his store poor-

ly lighted,

—Because nearly all electric lighting companies will furnish their customers, without charge, the service of competent illuminating experts,

—And correct lighting usually costs no more and frequently costs less than incorrect lighting.

Measuring Startight

Nearly all the measurements of the brightness of our heavenly bodies have heretofore been dependent on the observations of the human eye or the photographic plate, states Popular Electricity. Recently a new method has been devised which utilizes a certain property of the wonderful element-selenium. Selenium, when properly treated, is an element which in the dark offers a high resistance to the flow of electric current, but when illuminated it becomes a much better conductor of electricity. The selenium cell, as the instrument is called, is made by winding two parallel wires on a flat insulator. The wires are kept separated by melting selenium on their surfaces and then baking the cell at a temperature below the melting point of the selenium.

The usual procedure is to place the selenium cell in the focus of a telescope. The cell is contained in a light-proof box provided with a photographic shutter. When the measurement is taken the shutter is opened for a few seconds and

the cell is illuminated by the light from the star whose brightness is to be determined. The increase in the flow of electric current through the cell when illuminated is measured with exceedingly accurate instruments, and by comparison with measurements on objects of a known brightness the unknown brightness is readily obtained.

Stars are classified according to their "magnitude," which is determined by their brightness. By this method the light from any star can be focused on the selenium cell and a direct measurement of its brightness can be made. The method has also been used to study eclipses. It is especially valuable in determining the exact middle or maximum of solar and lunar eclipses. Measurements of the variation of the moon's light throughout the year have been studied. As an example of the measurements on the variation of the candle-power of the moon during its various phases it was found that the brightness was nine times greater at full moon than at half moon.





Light in the home is as we make it. It may be—a source of comfort, an inspiring influence, an element of the beautiful—or, in the utilitarian sense, just a part of things, a servant in the house, nothing more.

There is no other product of modern civilization which exercises so great an influence for good or evil in the home. Nerves may be shattered by its violent use, despondency and melancholia brightened by its subtle influence. Eye strain and chronic headache will result from its misuse. Eve comfort and visual acuity are the rewards of its intelligent appreciation. Taken as it is to-day in allopathic doses, as an antidote for darkness, artificial light is overstimulating and dangerous. Assimilated naturally in visually palatable homeopathic form, it is a wonderful tonic; but as prescribed by the incompetent, it is pitifully inadequate, and a deadly menace to the eyesight.

Let us momentarily consider the causes for such an unfortunate state of affairs. In the wholesale manufacture and distribution of artificial light, we are confronted with the inevitable triangle of human forces, slightly modified from the conventionalized triangle of the melodrama, but still a triangle in the functional sense. In this instance the triumvirate consists of:

First; the manufacturer of energy in luminous form from coal, popularly known as "that Gas or Electric Light Company," operating by franchise as a public service corporation. Second; the manufacturer of energy transforming devices—lamps, which convert gas or electricity (energy) into the visible luminous form of light, and their accessories, lighting glassware and fixtures. Third, but by no means least, the public which is theoretically presumed to enjoy, thrive, and prosper by the combination of the first and second forces named.

When the consumer of electric energy in the form of light has fault to find with the service rendered, he invariably accuses the lighting company. In most cases, however, the fault lies with the form of the lamp or the device for transforming the energy into light. This is the weak link in the chain that connects the consumer and producer. We have advanced toward a greater appreciation of aesthetic considerations in many things but we are ignorant where such consideration should apply in lighting. We might call this the

[EDITOR'S (HOUSE AND GARDEN) NOTE.]—Science has advanced much during the last decade in eliminating evils and correcting abuses, especially those connected with home living. We have a better architecture, more efficient means of sanitation, but in one department of the home we remain woefully ignorant. The question of illumination is answered to-day with little consideration of the æsthetic. We are entirely unaware of the vast possibilities of light as a means of decoration and know nothing of its subtle influence upon our health and even our mental attitude. Mr. Godinez has spent much time and careful research in this field and has astonishing disclosures to make that will awaken our dormant sensibilities. Although his criticism is direct, it is of the highest order in that he offers a remedy for each abuse which he makes apparent. He does not advocate any definite equipment, but he suggests how each individual may make use of his own to best advantage, and what are the desirable requisites of new material. In this article he tells his readers for the first time the important part light plays in their lives, its psychical effect upon us. In another issue he will give practical suggestions of great value and inspiration.

dark age of lighting paradoxical though it may be. We have plenty of brilliance but neither the conception of its proper use or the satisfactory means to enjoy it.

While the contractor and the architect's assistant are directly blamed for the perfunctory spirit in which they have placed impossible lighting equipment in the home, it must be admitted that they are utterly dependent upon the manufacturer of lighting accessories for the data which has been quantitive rather than qualitative.

An eminent authority on interior decoration states: "The technical man, or engineer, has narrowed his prospective by an exclusive consideration of economic and utilitarian, rather than aesthetic considerations. He has knowledge of lamps and their construction but smiles indulgently, and with smug complacency at the mere idea of aestheticism in lighting." He has no appreciation for environment-knows naught of that consistent relationship between light and color, which is the essence of decoration-or atmosphere. It is individuals of this negative type who are responsible for the unrealized possibilities of artificial light and who have offensively prohibited co-operation with those most eminently qualified by nature and experience to advance the cause of artificial light—the decorator and architect.

These criticisms do not apply to the illuminant manufacturer in the sense of belittling his achievement in illuminant improvement, for in the tungsten lamp of to-day, evolved by ceaseless experiments from Mr. Edison's first electric lamp of over thirty years ago, we have a luminous medium of singular flexibility and economy. Similarly, the pioneer work of Dr. Carl Auer Von Welsbach, has given to the world an incandescent gas mantle, at least, equaling the tungsten lamp in quantity and quality of light.

This question of quantity and quality of modern light sources is of grave import. Because he has succeeded in creating an illuminant which approximates daylight and assists industrial occupation, the illuminant manufacturer is laboring under the delusion that his tungsten lamp with its white light is a uni-

versal panacea for all lighting ills. So far, however, only the industrial utilitarian—and his commercial-economic aspects have received recognition.

In the lighting of the home, the glare of day perpetuated at night by artificial illuminants is unnatural—opposed to nature's teachings, entirely lacking in that element of repose which should delicately emphasize the quiet and peace of eventide.

Let us first consider the physiological aspect of artificial light in the home, and determine briefly just that constitutes

ocular hygiene and eve-comfort. One of the necessary requiretes for ocular confort is that the brillian y of a light source in the visual field should be restricted within certain limits. "Illuminating engineers" who have rudely invaded the field of the physiologist, have agreed after most exhaustive controversy that light sources having a specific brightness of from four to five candle power per square inch, down to 0.2 to 0.1 candle power per square inch as a minimum, are safe working standards for the eye. We are informed by the "illuminating engineer" that no absolute rule can be laid down, owing to "individually different requirements." This is a bit nearer the mark, but there is one positive method of determining whether or not the source of light is too bright. If it can be regarded fixedly without ocular discomfort, squinting, or annovance, it is not too bright from a physiological viewpoint. Whether it is a source of pleasure and a delight to the eye, is a psychological esthetic problem, which we will discuss later.

Do not confuse the "candle power" of "source brightness" or "intrinsic brilliancy" with the rated candle power of the light itself. The first is purely a measure of the brilliancy of various light sources expressed in candle power per square inch; and it is merely for comparative purposes that the reference is hereinafter used.

Of course in many instances the eye is protected from the dangerous brilliancy of the tungsten lamp, by some sort of glassware, which should serve the double function of eye protection and the redistribution of light over areas where it



is required. The fact remains, however, that no illuminant manufacturer has sincerely indicated the necessity for utilizing his product with care. Undue emphasis on its economical phase has persuaded the adoption of such lights in substitution for older types of less brilliant illuminations, but nothing has been said about eye strain and its prevention.

Since the days of the candle the source brightness our illuminants has steadily in eased. It has passed the danger mak, but the saturation point is not yet in sight. If values of from 0.1 to five candle power per square inch constitute the maximum range of brightness that is safe for human eyesight, glance at the following tabulation, and cease to marvel at the oculist's prosperity:

		Intrinsic bril-
		liancy candle-
		power per
Source of Lig	ht:	square inch.
Oil lamp		3- 8
Gas flame		3-8
Carbon filament	electric lamp	375
Welsbach gas n	nantle	20-50

From an inspection of the above it is apparent that each successive development of electrical illuminants has been attended with an amazing increase in source brightness, and where a value of five candle power per square inch is considered the limit of safety, we have exceeded that limit two hundred times!

The human eye is but an extended portion of the brain, according to the most eminent anatomists, and as such must be treated as no mere auixliary optical equipment, but instead, as a vital anatomical organ affecting in some important manner every other organ. Thus, the glaring unprotected light source whether it be the typical light of the subway train or some too brilliant light in the home is the unsuspected cause of many an acute headache, which with continued exposure will become chronic. Indigestion and nervous despondency have also been traced to this cause. The physiological significance of color, or quality of light in the home, brings us to the reading page. A great deal of humanity's ocu-

discomfort has come from deavoring to decipher small black characters against a white page. In the days of earlier illuminants the page was perhaps insufficiently lighted and evesight was impaired through strained perception. Then came the oil lamp with its soft, mellow radiance, which has still many admirers in the student world. We see the small print on our reading page by contrast. The contrast of the black type against the white background, but the area occupied by the blank white paper is far greater than the area occupied by the black type. In other words, the blank, white area, which serves to reflect or diffuse light from a lamp into the eve. reflects more than is necessary to perceive the printed matter by contrast. With earlier forms of electric illuminants the white page was modified by the amber color of the light source, and against this soft, mellow background the contrast of the small black characters was less abrupt and more readily perceptible. With the tungsten lamp, the reading page is glaring white, reflecting so much light into the eye that comfortable perception is impossible.

Assuredly we desire to enjoy the economic advantages of these modern illuminants, but let us temper their use with respect to our eyesight. With the same quantity of amber and white light on two reading pages, any person will be able to read longer, and more comfortable with the amber light.

Since the illuminant manufacturer and "illuminating engineer" will not recognize the obvious physiological requirements of the reading light, let every person interested in conservation of vision prescribe his own remedy, for the proce-

dure is simplicity personified. Granting that the requirements of the individual differ. Then let the individual recognize his requirements.

There is to-day, a material termed "gelatine film" which is manufactured in sheets, about two feet



square. It is a thin, transparent medium employed in the theater for the projection of colored lights and the attainment of realism in scenic effects. It is available in many colors, including amber, and is practically fireproof. It may be cylindrically shaped to conform with the various sizes of modern light sources, and held in place by ordinary paper clips, such as are used in attaching office correspondence. It may be obtained at any electric stagelighting supply houses, for a few cents.

While a fluid preparation, known as "lamp coloring" has been available for staining lamp bulbs, its application has been limited to exterior sign effects. Moreover, it is impossible to obtain permanency of color or variation of color density with its use, and the operation of "dipping" lamps in coloring solutions is fraught with many uncertainties.

The standard makers of incandescent gas mantles, recognizing sometime ago that a white light mantle was unsuited



DO NOT DESECRATE THE ENVIRONMENT OF THE HOME WITH COMMONPLACE LIGHTING GLASSWARE TYPICAL OF THE STORE, WAREROOM, OFFICE AND FACTORY. WHATEVER IS GOOD IN DECORATION EXPRESSES A CONSISTENT RELATIONSHIP BETWEEN LIGHT AND COLOR. THE ATMOSPHERE OF THE HOME AS INFLUENCED BY LIGHT SHOULD REFLECT REFINEMENT, NOT VULGARITY.

It will make light sources which are an annoyance to the eye, soft and attractive. It may be inserted in cylindrical form about an illumininant, without removing its shade, or globe.

Just one experiment will convincingly demonstrate its ability to transform harsh, white light into the soft, agreeable radiance of the oil lamp. Any density of color may be obtained by increasing the number of layers forming the amber cylinder.

for home lighting, devised what is termed an "amber light mantle," which is most pleasing and restful to the eye. Unfortunately, the manufacturers of electric lights have not considered this matter.

Too much emphasis cannot be laid on this question of light modification. Great physical discomfort has resulted from the substitution of high intrinsic brilliancy light sources for older types of illuminants to which visual functions had become accommodated. Overstimulation of the retina decomposes the visual purple much more rapidly than it can be restored, and the result is retinal exhaustion followed by its attendant depression of other

organic functions.

That occasional feeling of drowsiness sometimes noticeable in the brilliantly overlighted drawing-room, is due to retinal over-stimulation, and the expenditure of nervous energy wasted in the continued muscular effort expended in squinting and browpuckering to exclude the annoying glare.

Similarly those who immediately after dining peruse an over-brightly lighted reading page add to digestive exertions the burden of an ocular-muscular action in-

spiring fatigue and drowsiness.

There are other reasons why a white light is undesirable in the home, and these involve psychology. Subconsciously

and unconsciously we experience many sensations which are directly due to psychological precedent. Unexpected contact with a subtle perfume, a certain quaver in a musical theme, and instantly our mind reverts long, long ago, to some incident or personality revivifying the past with startling realism. Through the interminable space of centuries humanity has been trained through hereditary psychological precedent to regard light as a symbol of warmth,

comfort, and repose. For ages the comfort of the open fire has impressed on the subconscious mind the invariable association of that physical comfort with the coloring of the dancing flames. Recall the pictorial beauty of the setting sun, transfiguring everything with its kindly radiance, and know why nature's teaching has endeared to humanity that soft, mellow quality of light which imbues the environment of the home with an atmosphere rich in tone, feeling and expression.

No woman can appear to advantage beneath the cold, harsh, white light of modern illuminants which cruelly reveal every wrinkle and emphasize every facial blemish. Even the bloom of youth pales under the brutal glare of the tungsten lamp when it is unmodified.

Schopenhauer and Herbert Spencer devoted most exhaustive research to determine the effect of music on the nerves; vet the influence of color, particularly on the overwrought nervous system, is even more definitely marked. The great student of chromotherapy, Van Bliervliet, maintains that those senses which are most sensitive to color appreciation, directly stimulate intellectuality, indicating that those individuals possessing superior intelligence are particularly susceptible to the suggestion of color or music. Nervous prostration, lack of literary inspiration, and insomnia may be relieved, restored, and cured by the proper treatment of light and

To-day the lighting of the office is harsh, white and cold. Why let the light of the home suggest to the mind of the tired business man working conditions?

This subject of psychology is irrevocably linked with artificial light, particularly in the home—which is the theater of life. Once a dramatist, more daring than his fellows, staged a play. It dealt with the psychology of light. The critics read the manuscript and predicted failure. As usual the public decided. It was a wonderful success. Night after night thousands sat spellbound under the psychological influence of light. The "illuminating engineer" was

not in evidence. Possibly he was asleep

in the gallery.

The following abstract from one of the scenes will interest all in whom the sense of imagination and power to appreciate logic still holds sway.

Vavin, a scientist, is discovered with Halcomb and Dora—the lovers of the play. Before leaving them alone in the moonlight, he administers, gratuitously a psychological benediction:

Vavin-Do you know the effect of

color?

Halcomb—Color?

Vavin—You have heard of Nancy—in France—the town?

Halcomb-Yes.

Vavin-And Dr. Charcot?

Halcomb—Yes.

Vavin-He was my friend. We made

together many experiments of the effect of color upon many persons under hypnotic influence. Invariably under yellow, or amber, the subject laughs; under green he is content; under red he is stimulated; if it is brown he is in fear; if violet he weeps; under blue he is-what you call it-distrait?

Dora—Perplexed? Vavin-Perplexed! Halcomb—Don't you think, Monsieur, rises nearly an hour later each night.

Halcomb-Well?

Vavin—The harvest moon at the full comes up three nights almost at the same time. Did you ever think of that?-and why is it, do you suppose?

Halcomb—Why?

Vavin-That harvesters, men and women, shall fall in love with each other! Oh, it is a droll God, Monsieur, that plays that trick for one hour on His



LIGHT IS A SYMBOL OF DECORATION, AND SHOULD BE EMPLOYED AS SUCH IN DELICATELY EMPHASIZ-ING THE PICTORIAL BEAUTY OF AN INTERIOR, BE IT EVER SO HUMBLE. GOOD DECORATION SUFFERS FROM OVERLIGHTING. THERE MUST BE SHADOWS-LIGHT and SHADE. A TOUCH OF LIGHT AGAINST A TAPESTRY OR A SPRIG OF BLOSSOMS-AND THE THING IS DONE.

so much attention to the light is a bit theatrical?

Vavin—Theatrical?

Halcomb-Not true to life.

Vavin-Life? Do you know, Monsieur, that sixty per cent. of the causes of falling in love are in the moonlight in life?—Do you know the harvest moon?

Halcomb—You mean the full moon that comes at harvest time?

Vavin (nodding)—Do you know its peculiarity? Generally the full moon children. Think of it, Monsieur, a harvest moon for one hour! Is that of the theater? No; it is a droll God. Now, I cannot show you; I have no arrangement to get the blue light, which is mystery, and the green light, which is content, and which together make a moonlight-when two people come together, mystified and happy, and say "Ah, this is Fate—we were for each other since the beginning."

(To be continued)

Some Educational Considerations

How often one finds an "educated" man who lacks "horse sense"!

Some men are so well "educated"—slaves to precedents that seldom fully re-occur—that by the time they get their uninitiated "book learning" in motion opportunity has shrunken or has ceased to exist.

A trouble with much so-called educational work is that, aside from its character, the method of its impartment ofttimes stifles the more or less embryonate imagination—creative powers—of the individual.

The highly academic attitude sometimes effected by some educators may impress the student with the importance of the

subject—then again it may not.

Not infrequently the student is caused to regard the act of learning as obnoxious labor, and he partakes of his subject with about the same degree of pleasure as he would evidence in "taking" castor oil: both probably accomplish some good, but nowhere near as much as if the recipient's mental attitude were agreeably inclined.

There is no particularly good reason why knowledge cannot be imparted in an interesting manner, except it be that the instructor is incompetent, which many times, unfortunately, is the case. Many instructors lack the initiative. They have absorbed their knowledge in the same humdrum, "mechanical," unthinking manner that they, in turn, reiterate in parrot fashion to their hearers.

To most men of this type the original is a dreadful, untried thing that should usually be very carefully avoided, for who knows what terrible disaster—calamity—the application of the original may effect!

The old tried and true method is the best—according to persons of this class—because it is old, even though, at times,

quite antiquated and foreign to present practise and requirements.

Afterwards, when such advance knowledge finds its way into text books and the craniums of "precedent" educators—why, it's old—there is something else new; and so such "education" goes.

Knowledge ofttimes arrives after the student has departed his educator and finds himself confronted with new, unknown theories and methods that he finds difficulty in appraising and applying.

Here may lie the difference between theory and practise, and, in a measure, may account for some of the difficulty that many persons fresh from college experience in adjusting themselves to practical working conditions.

There are certain basic laws that seem to stand the test of time, although how many theories have evaporated and how many have been the ideas condemned—judged as impossible—that have been developed and put in actual practise!

This outburst is not without respect for the great import of educational policy as is, but more an attempt to accord to originality and practicability, and methods of their impartment, the value due these important factors of knowledge and work.

Let us briefly consider the relation of originality and practicability to the subject of light, in which, naturally, we are

greatly concerned.

The general awakening to the importance of the correct use of light, and the educational work that followed, may be attributed, first, to certain manufacturing interests; second, to the press; third, to the Illuminating Engineering Society and associations, who have, from time to time, considered some phases of the subject; fourth, the public utilities (Central Stations and Gas Companies); fifth, profes-

sors, and, last, but by no means least, broad-gauged, advanced thinking *lighting*

specialists.

An analysis shows that the manufacturing interests had first something original and meritorious, and even though their educational propaganda had as its primary motive the disposal of the particular commodity in which they were commercially interested, such effort did create and stimulate thought and interest.

This pioneer work was commercially productive to its exponents, and, likewise, of benefit to the public and the lighting industry as a whole. The work is unique

in the annals of commerce.

The press, largely actuated or influenced—if not propelled—by such commercial activity, and with little degree of originality or consideration for the subject in its entirety, to a large extent reiterated—sometimes in new dress—the interpretations of the first-named class.

The Illuminating Engineering Society further considered the pioneer ideas and efforts of the manufacturing interests.

The Public Utilities accepted, at first, co-operation from the three named classes, and later, in some few cases, sought more comprehensive, independent revenue-producing assistance. The co-operation first extended undoubtedly had a decided beneficial effect on developments, but it benefitted the manufacturers considerably more than it did the public (consumers of energy) and the Central Station and Gas Companies.

The fifth class is of a peculiar nature. Here we have, in most cases, physicists, electrical engineers, physiologists, etc., who, in their academic work, treat with some one phase involved in the subject of light, and who, now partly realizing the demand and need of lighting educational work, are taking advantage of the opportunity presented to add to their incomes.

These educators, for the most part, while being perhaps well qualified in their particular field of endeavor, know little or nothing of the subject of light in its entirety—the relation and import of one phase to another; therefore their teaching has little effect in furthering desirable advancement.

Furthermore, what information they do endeavor to impart is usually expressed so uninterestingly—"dry"—that their listeners are bored, instead of being enter-

tained while being instructed.

Inasmuch as such types of educators are usually ignorant of the ramifications and relations of the subject of light, they, through fear based on ignorance, are prevented from expressing other than timeworn, antiquated ideas, for the most part contained in more or less obsolete text books; and should this class of instructors draw on their untrained imaginations, they generally turn to theory—based not always on correct assumption—rather than practise—based on fact and experience.

The fifth, and last referred-to, class is

different-quite.

First, this class, small in numbers, have no commercial affiliations, and can, therefore, suggest the really best for any and all conditions.

This in itself is a very great advantage

in their favor.

Second, their knowledge being based on practise (experience), as well as theory, is broad and practical—constructive.

Third, they are sympathetic and considerate of all phases involved, which, with full working knowledge, assure results that are consistent and satisfactory.

Fourth, they have imaginations which they freely draw on, the outcome being guided by experience, such consideration assuring results removed from the depressing, monotonous, unproductive common-place.

Fifth, being independent, they serve one master. Two masters cannot, with justice, be served. Results and conditions

speak for themselves.

Sixth, knowing, as these lighting specialists do, the actual conditions confronting representatives of central stations and gas companies, they tender suggestions that quickly overcome obstacles. Such demonstration of practical, constructive suggestions, authoritatively conveyed in an interesting manner, assures the respect and support of the solicitors. Thus increased revenue is obtained from satisfied consumers through the effort of interested representatives whose efforts are directed by the specialist.

Such is the outgrowth of the first five named classes. Such type of educator (lighting specialist) stands for and assures real advancement.

Central stations and gas companies before arranging for educational work should assure themselves that the instructor under consideration is possessed with at least the following qualifications:

Absolutely independent—no connections whatsoever which would influence his thought or action for other than those interests he is retained to serve—the central station or gas company, as the case may be.

There are many pseudo lighting experts masquerading under various titles, such as, for instance, "illuminating engineer," and who are usually plain salesmen with something to sell, which in itself may be a very honorable occupation—if conducted with respect for the ethics involved.

The assurance should be had that the instructor possesses sound, comprehensive, practical knowledge, not only as regards the characteristics of all illuminants—gas, electricity, oil, etc.—and their application to all classes of service, insuring full satisfaction to the consumer, but also the effect of such introduction on the revenue and policy of the public utility.

Such a person must, besides possessing actual, basic, practical knowledge, be gifted with considerable imaginative powers, for variety of lighting equipment design and application is most necessary.

Any person who relies solely, as many do, on the purely "mechanical," will sconer or later breed monotony and rob lighting of its individuality, which is a source of distinct pleasure in the home, and of considerable advertising value in the business world.

It also should be remembered that not all who possess knowledge have the knack of imparting it. One may be ever so bright and clever and yet be without effective method of expression.

It should be remembered that in treating with light one is dealing with a greatly diversified subject, and that the state of the art and science is yet so embryonate that unless care is exercised in its treatment and expression, that many false notions may easily be created—and once such

erroneous ideas are established, they are difficult to eradicate.

Extreme care, therefore, should be used in the early stages of educational work that assurance may be had that the basic knowledge — foundation — created will permit of a large, valuable structure.

Therefore the instructor should employ experiments that appeal at once to the imagination and reason, making his points so entertaining that interest will be aroused and the desire to learn firmly established—which condition is ofttimes the reverse of what we find—employing methods that, while more or less spectacular, do not create false impressions—but express the truth entertainingly.

The instructor should possess a personality that commands the respect and good fellowship of his class. His statements should be with a full knowledge of the requirements of the public utilities, and the actual conditions encountered by the representatives in their daily work.

The representatives must feel that the instructor knows *their* problems as well as the solutions before the instructor can gain the representatives' confidences—a most important requisite.

Personal contact with representatives in educational work is of considerable importance, for then the representatives have the opportunity of asking questions besides being greatly benefitted by hearing general discussion.

An entertaining lecture is enjoyable; correspondence is usually work—drudgery.

Most of us humans enjoy pleasurable recreations: that is what a well conducted educational course should be, can be, and is—sometimes.

Public Utilities should fully realize that they engage their representatives to work for them, consequently the knowledge obtained by the representatives should be unbiased—truthful—and of a nature calculated to develop satisfied consumers—the asset of all public utilities. Furthermore, that increased revenue will be assured that will enable the representatives to receive a more desirable remuneration.

The subject of educational work is one of very great importance, and the Public Utility contemplating such work would do

well to consider all aspects involved. Practical assistance is the expressed desire of lighting representatives.

Let us see that this important produc-

ing class get what they want and need. Such work is not only possible, but has been accomplished with excellent results to all concerned.



An extraordinary light, noticed frequently in the past above the crests of the Chilean Andes, has appeared again, and those who live within a radius of four hundred miles from the main ridges of the Cordilleras are watching its appearance with increasing curiosity. The cause of this form of effulgence is stated variously. "To authoritative opinion, however," says a Chilean correspondent in the Diario de la Marina (Havana), "this light seems to have fixed points of issue in most instances, and only the frequency of its discharge and its extent appears to change." He goes on:

"Ordinarily the light has a glistening appearance, and commonly its boundary has the shape of a bold curve; not seldom it is seen only on one side of the Cordilleran group. The most vivid, the most powerful flashing occurs at a definite point, and it sometimes rises several degrees above the main Cordilleran crest. Often the discharges seem to reach beyond the zenith and consequently over the socalled Artists' Cordillera, and far away to When the sky is clear the phenomenon can be perceived with ease; and during long intervals after darkness it can be observed day by day. Of course, it may be present also during daylight, but it is not then observable.

"It begins in late spring and lasts till the approach of winter; and toward the south this phenomenal light becomes gradually less or ceases altogether. In northern and central Chile, in Bolivia, and probably, too, in Peru, this flashing is seen, although in occasional long intervals of their joint area it apparently

fails to appear.

"Quite recently a naturalist, during a journey through a valley of the main Cordillera, observed this phenomenon with One evening about nine exactness. o'clock, while studying an unusual and frequent discharge, he was able to ascertain that its point of issue was an elevation of the Cordillera along which he was roaming. Moving constantly around this peak was a band shaped like a segment of one or two degrees in height and somewhat similar to the zodiacal light in brightness. During the present season the light has glistened as usual, but with much greater strength, and especially above the discharge, into which the glistening has disappeared after a moderate interval. The naturalist believes that this flashing of the Andes is due to profuse electric discharges in certain districts of their Chilean section, and particularly among the greater peaks. The predominating popular view is that this light is a reflection of the molten lava in volcanic craters. Such a view is erroneous, however. It is not improbable that the number of the points at which these discharges occur changes; and it is possible, too, that during the great earthquake of August, 1906, discharges occurred along the whole crest, for, if we may accept authoritative statement, the sky everywhere in central Chile then flashed with a quivering 'fire,' such as was never seen either previously or thereafter."-Translation made for The Literary Digest.

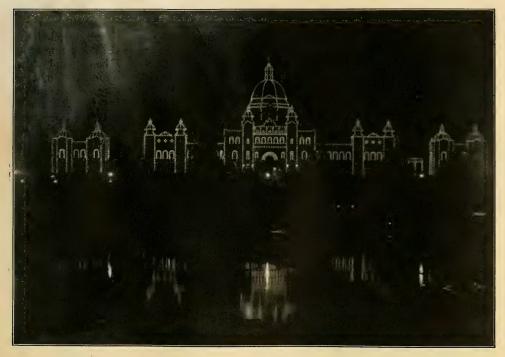
SPECIAL DECORATIVE LIGHTING EFFECTS IN VANCOUVER AND VICTORIA, CANADA · · · ·

BY FRANKHARRIS

(Note.—Photographs courtesy B. C. Electric Railway Co. of Vancouver and Victoria, British Columbia.)

The recent visit of the Governor General of Canada, the Duke of Connaught, accompanied by the Duchess and Princess Patricia, to the Pacific coast of the Dominion was the occasion of a great celebration, it being the first visit of a member of the royal family to that section

true in the larger cities of British Columbia, Vancouver and Victoria, where the B. C. Electric Railway Co. gave every assistance to the committees in charge of the work in order that the electrical displays might be of superior order. In both cities ornamental lighting is now

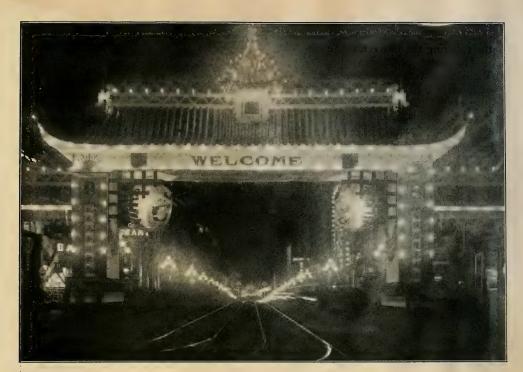


PARLIAMENT BUILDINGS, VICTORIA, B. C. FORTY-FOUR HUNDRED LAMPS USED.

for some years. Great preparations were everywhere made for the noted visitor and his party and the cities in which he made stays of any length were profusely decorated in honor of the occasion. Electrical illuminations formed a prominent feature of the decorations, this being especially

well established throughout the business districts and this form of illumination contributed its share to the general effect on the streets at night.

Accompanying this article will be found views showing the high standard of illuminations in Vancouver and Vic-



CHINESE ARCH, VICTORIA, B. C



GENERAL LIGHTING DISPLAY.

toria during the Governor General's visit.

The most prominent illumination in Vancouver was that of the office building of the B. C. Electric at Carrall and Hastings streets, in the center of the business district. This five-story structure was only recently completed and the block was first illuminated at the time of the Duke's visit. Over 5,000 lamps were used to carry out the plan. Around the upper cornic of the building was a row of 40-watt tungsten lamps, located in coves of the coping, this installation forming part

roof. The illuminations on the ground floor were rendered especially attractive by 12 regenerative flame arcs, located between the arches forming this story of the structure. On the Hastings street side of the building "God Save the King" was displayed in letters two feet high and this decoration was surmounted by a crown in which 200 plain and colored lamps were used. The illuminations of the B. C. Electric block elicited compliments from the royal visitors and the lighting scheme was commented upon very



B. C. ELECTRIC COMPANY'S BUILDING, VANCOUVER, B. C.

of the permanent lighting equipment of the building. Below the cornice the building was completely outlined by strings of 4-watt tungsten lamps. Over the archways of the ground floor and the entrance to the interurban terminal station, rows of the smaller tungstens were also placed. Around the top of the cornice was placed a string of powerful tungstens and the flagpole of the building was outlined and surmounted by a circlet of powerful lights with three strings of incandescents forming a cascade from the pole to the

favorably by illuminating experts from all parts who witnessed it.

The streets of Vancouver were brilliantly illuminated at night during the Governor General's visit. Twelve large arches spanned various sections of the banks streets, all of which were brilliantly illuminated at night. The view of Vancouver streets shown in connection with this article is that of Hastings street from Granville, looking east. The arch to the left and in the foreground is the city arch, while that directly in



EMPRESS HOTEL, VICTORIA, B. C.

the center of the picture is the Canadian Northern Railway arch, through which might be seen the illuminations of the arch erected by the Italian residents of Vancouver. The building to the right in the foreground is that of the Canadian Bank of Commerce, the outline illuminations of which made an excellent effect.

The B. C. Electric operates in Victoria as well as Vancouver and the illuminations in the Capital city of the province were carried out on fully as extensive a

scale as in Vancouver.

The effect of the Victoria illuminations was greatly heightened by reason of the finest electrical displays being those of large buildings located on embankments along the water front, the view from the bay with the water reflections being very effective.

Two views of the waterfront illuminations in Victoria are given in connection with this article. In the decorations of the Parliament Building, about 4,500 lamps were employed, the outline showing perfectly the large buildings surmounted by their central dome and smaller towers. The electrical illuminations of the Parliament Building were installed so that the wiring is now permanent and will be available for future illuminations.

The Empress Hotel had one of the most effective displays on the coast, the entire building being illuminated in outline form with powerful lights. On the face of the building was a large British flag in colored lights and on the roof a large crown was placed at the base of the flagpole, while at the top of the pole was a brilliant star composed of powerful lights.

The arches erected in Victoria in honor of the royal visitor were numerous and beautiful. A view is shown of the arch erected by the Chinese residents, this being of unique oriental design. In the illumination of this arch 800 lamps were used.

The electrical illuminations during the visit of the Governor General to the Canadian Pacific coast have set a new standard for work of this class, and the manner in which the various plans were carried out was commented upon in a very favorable manner by many lighting experts from the large cities in the states who were present in the city during the time of the royal visit.

DANGER OF LOOKING AT BRIGHT LIGHTS

If the iris were perfect in its function, looking at bright lights would not be annoying, or in some cases actually dangerous, for the iris would shut down to a small sized pinhole. But the iris is far from being perfect in its action; when it is contracted to about 2 mm. usually it will go no further no matter how bright the light may be, and this means that the retina may be exposed to an excessive amount of light which results in scotoma or sometimes worse. As a rule we avoid looking at a bright light of any kind, but at the time of an eclipse of the sun there are many people who are so curious as to

what is happening to old Sol that they will try to look directly at him. This results in scotoma which may persist for a long time and which in some cases may become permanent.

It has not been settled satisfactorily whether injuries caused by bright lights are due to light rays or to heat rays or to actinic rays, but probably all have a part in the result. In any event it is never wise for a person to look directly at a very bright light, for if the light is very strong and it is fixed even for a brief time, there may be changes in the retina which never can be remedied.



THE NEW HOME OF THE KENTUCKY ELECTRIC COMPANY

LOUISVILLE, KENTUCKY

BY C. C. OUSLEY

Proud title to the most unique and effective exterior illumination in the United States is claimed for the "Electric Building," occupied as the new home of the Kentucky Electric Company in Louisville. The building is located on Fourth Street, south of Chestnut, almost in the very heart of the retail business district. It was erected especially for the Kentucky Electric Company and besides housing the executive and commercial offices of the Louisville public utility, it also provides spacious display rooms that probably have no superior in the entire country.

The "Electric Building" is three stories in height, with a frontage on Fourth Street of about forty-five feet. A basement with high ceiling underlies the entire structure. The front of the building is constructed of tile in attractive design, with large plate glass windows so located in each story as to give a crystal palace effect to the building. While the structure is an architectural masterpiece in the daytime, probably its greatest beauty is to be found in its unusual illumination possibilities. Five rows of round bulb frosted lamps, hanging pendent, serve to bring out the graceful lines of the front of the building. The name of the company is carried across the front in a horizontal sign at the top of the first story. At the north and south corners of the building, flush with the front edge, vertical signs bearing the company's trademark and the words "Light" and "Power," respectively, are installed.

The signs and pendent lamps carry out the intention of the architect to provide the exterior of the building with a clear but subdued light, which gives a framework for the brilliant interior display through the great plate glass windows. The letters on the signs are enclosed in deep grooves, and all sign lamps are frosted. The grooves are topped with a white enamel perforated covering. Through these little openings the rays of light are reflected from the white enamel background of the sign grooves. Thus while the entire front of the building is plainly outlined by night and the beauties of its ornamentation can be thoroughly enjoyed, the light is so subdued as not to detract from the interior of the building.

The windows are brilliantly illuminated with tungsten lamps installed in intensifying shades. The interior illumination is beautifully effected by special lighting fixtures in which are installed 300 watt tungsten lamps suspended from the white ceiling area and the three floors are thus brought to the view of the passing pedestrian in a brilliant picture.

The completion of this truly wonderful illumination will be accomplished early in December when a handsome sign will be installed on the roof of the "Electric Building." The contract for the sign has been let to the company which built and installed the famous "chariot race" sign in New York. The sign is to be in operation by December 10 and will be one of the largest electric signs away from Broadway.

It will tell a story in four chapters of the uses of electricity in the home and will require more than four minutes to complete this story. Between the two great supporting columns erected for its support the sign will span a distance of 56 ft. The sign proper will be 35 ft. high and mounted 15 ft. above the roof of the building. This will bring the top of the giant device a distance of 100 ft. above the sidewalk. A motor, outlined in electric lights, located on a pedestal in the center of the sign, will operate two



"THE ELECTRIC BUILDING." NEW OFFICE BUILDING AND DISPLAY ROOMS OF THE KENTUCKY ELECTRIC COMPANY, LOUISVILLE.



"ELECTRIC EXPOSITION" CONDUCTED BY THE KENTUCKY ELECTRIC COMPANY, LOUISVILLE, IN ITS NEW OFFICE BUILDING AND DISPLAY ROOMS.

generators raised on supporting pillars. Four circles will be used to frame the pictures illustrating the home story. The first illustration will show a woman reading by an electric lamp, while in the circle on the opposite side of the sign will be seen a woman ironing with an electric When these two illustrations go out, the third and fourth illustrations, respectively, will appear in the other circles, one showing a woman using a sewing machine with electric motor attachment and the other, a housewife sweeping with a vacuum cleaner. As a finale to this lifelike motor story, the whole sign will burst into a blaze of multi-colored lights and there will then be a brief period of total darkness before the whole performance is About 3,400 lamps will be used in the sign. During the telling of the story the name "Kentucky Electric Company" and the words "Light" and "Power" will be brought to the attention of the passing audience.

A permanent exposition has been inaugurated by the company in the spacious display rooms which occupy over one-half of the ground floor of the new building. Between the hours of eight and six o'clock every week day the exposition is open to the public and some idea of its popularity may be gained when it is known that not less than 20,000 persons attended during the opening week. "Over 100 uses of electricity in the home, office, store and factory under constant demonstration" is the line of advertising "KY-EL-CO" gives to the people of Louisville and it is evidently proving effective as an inspiration to increased interest in things electrical. A photograph of this beautiful interior is shown, along with a picture of the exterior of the building under illumination.



LIGHT The Life of Photography By Powell M. Culick

When mixed with organic matter and exposed to light, the glass plate or film with its coating of sensitized gelatine containing the silver salts, change color. On this fact is based the phenomena of photography.

Photography then, is the imprinted impression of objects, caused by the action of light, on chemically treated surfaces, and is dependent for its life on three agencies. Chemically prepared plates and paper, suitable lens and camera and last but most important of all—light.

Whether it be in the studio, or afield, or whether it be in the Egyptian darkness of a moonless, starless night, light is the principal essential to the success of the portrait or photograph to be taken.

On its artistic arrangement to secure the proper assembly from high light to deepest shadow, properly distributed at the right time and in the right place, its value can never be over estimated and yet, while photography depends upon it for its very existence, used at the wrong time it acts as a destructive agent that leads to disappointment, inconvenience and often times heart rending failure. Upon it depends that truth of delineation which alone can make a photograph valuable as a portrait, as well as rendering a portrait pleasing and interesting, combining as it does truth of the highest with effectiveness and beauty with the resultant satisfaction of something accomplished in a masterful manner.

What is this all important agent which at will can make or mar what the lens of the camera tries to impress on its sensitive brain—the film or plate? We know it is called light, but then, what is light and what causes it?

"Light is caused by the vibrations of that space pervader commonly termed ether, and consists of separate and independent parts which travel in straight lines at uniform speed. Every visible object about us is a light factor, either by its self luminous powers, or by the power borrowed from a self luminous body. As it travels on, it meets other bodies which either deflect its course or act as a medium through which it passes. Such a medium is called transparent, while the body that deflects its course is called opaque.

Light bears the same relation to photography that oxygen bears to life. Without it, the eye (the lens) of the camera is as useless in portraying objects on the silver salt prepared plate or film as is the retina of the human eye obscured by

a cataract.

When the plate or film is placed in the camera and exposed, the light, coming from the object photographed, changes the silver salts in the gelatine coating, in proportion to the brilliancy of the luminous or illuminated body. Where the intense light falls upon the plate, the deposit left by the developer is heavier than where little or no light fell.

In order to measure the intensity of the light transmitted, a photo meter is used. The action of this accessory to photography is based on the period of time taken by the light to discolor the photographically active material to a given shade. The greater the intensity of light, the shorter the period of time taken to discolor the sensitive material.

You have no doubt wondered why the photographer in the studio, when getting a proper focus for his lens, stands with a dark cloth thrown over his shoulder until the camera has been adjusted to his satisfaction.

This is done in order that no light may fall from the back of the glass screen, onto the ground glass screen he faces, while he focuses the lens on the object to be photographed, until he sees a distinct delineation defined on the screen.

One ray of solar light is a greater aid,

and more valuable to photography than all the brightness derived from any known artificial light, and for this reason, the studio must so be planned, that every possible outside light is concentrated within its confines. It is the lighting which gives the illusion of relief, and imparts that character and variety into the photographed object which makes of it a speaking likeness. Its proper study is as important if not more so, than is the art of posing. Posing alone, without the aid of knowing how to apply, and when to do so, the proper amalgamation of light, shade and shadow, will convert the most characteristic object full of expression and poise, into a mere nonentity.

Sky light alone is inadequate to convert a photograph into a work of art, equaling, if not excelling the master painter's impressions in oil, on canvas.

Let this fact be understood thoroughly. Let it impregnate the mind until the value of its importance acts as a fulcrum on which rests the success of the photographer who has studied and applied the lesson of light, on its relation to photography.

Side light without sky light is photographical suicide; that is, in delineating the model so that the result will be a work of satisfaction to the one photographed, as well as to the one behind the camera. The form and the features are altered almost beyond recognition and the photograph instead of picturing an object in which burns the spark of life, shows nothing but a figure without expression—lusterless—dead.

In every studio the character of the light is constantly changing, therefore the ideal studio is the one in which the skylight and the side light bring about that happy union which makes such a studio a palace chamber instead of a cell of tor-

ture for the model. Such a studio should face the north. Its skylight of ground glass which rids the room of reflections and produces a soft light which is pleasing to the eye, yet of sufficient strength to produce the desired results, should be at an angle of say 45 degrees. The side light in this studio should be of the same ground glass, about one-third the width of the room and should extend about 55 per cent. of its height, beginning, say two feet from the floor.

Lighted in this manner the studio possesses that happy blending of soft light and soft shadow, which give the posed figure gentle rounding, and good definition, and "conceals rather than empha-

sizes a possible blemish."

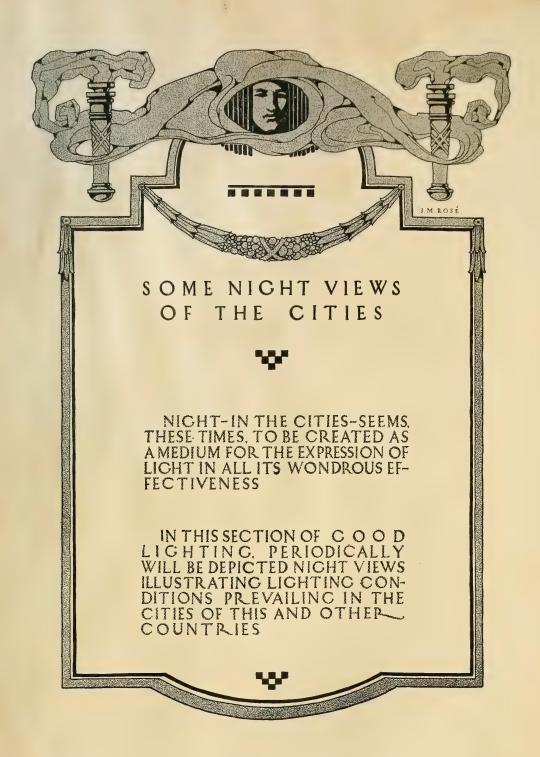
In order to bring such a combination about, and to have proper control over it so as to regulate and direct the entering light from the top and the sides a system of shades, blinds and curtains, preferably of dark gray material, should be so adjusted that with little or no effort the operator may secure by the proper adjustment of these shades the desired diffused, direct or reflected light as the contingency of the moment calls for. It must be remembered that a strong light or too great diffusion over the whole face or body will destroy the character, producing violent contrast of shadow and light thereby rendering an otherwise good photograph flat and uninteresting, while a judicious blending of light and shadow will create a good portraiture. The most favorable direction for the light to fall is at an angle of about 45 degrees from above, and ten to twenty degrees back of the falling light.

(Continued, with illustrations, in next issue.)

Illuminated Vest Buttons

An addition to the class of devices called electrical novelties is contained in a patent issued to Everette S. Lagarde and Peter A. Augenend, Jr., Houston, Texas. Illuminated vest or coat buttons are con-

structed to hold each a small electric lamp. A battery and push button complete the outfit, enabling the wearer to light up the buttons at his pleasure by pushing the button.





Courtesy Philadelphia Electric Company.

MARKET STREET, PHILADELPHIA, WEST OF CITY HALL, TOWER SHOWING NEW STREET ILLUMINATION,
ALSO PENNSYLVANIA RAILROAD.



Courtesy Buffalo General Electric Co.

BUFFALO, N. Y., VIEW FROM NEW BUILDING OF THE BUFFALO GENERAL ELECTRIC COMPANY. WHITE STREAKS NOTED IN PICTURE ARE RAYS SENT OUT FROM SEARCHLIGHTS LOCATED ON TOP OF ELECTRIC COMPANY'S BUILDING.



Courtesy New York Edison Company.

THE PLAZA, FROM CENTRAL PARK, NEW YORK.



Courtesy New York Edison Company.

WASHINGTON STATUE ON THE STEPS OF THE SUB-TREASURY, WALL STREET, NEW YORK.



Courtesy Consolidated Gas and Electric Light and Power Company.

BALTIMORE, MD., AT NICHT FROM THE BAY.



Courtesy St. Paul Gaslight Company.

St. Paul's Great White Way, St. Paul, Minn.



Courtesy Syracuse Lighting Company.

ORNAMENTAL STREET LIGHTING, SOUTH SALINO STREET, SYRACUSE, N. Y.

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SOME PHASES OF THE ILLUMINATION OF INTERIORS.

* WITH INTRODUCTORY REMARKS REGARD-INC THE ILLUMINATING ENGINEERING SOCIETY

BY PRESTON S. MILLAR

The business of the lighting company is to sell illuminating, power and heating service. Its s and achievements are broader than mere selling of electrical the conduct of its busienergy or g. ness, the ve organized large lighting company met here on its staff, power experts, heat and tilation experts, and illumination The illumination well qualified to deal with expert should lighting problems, and to the extent that his services are applied on behalf of the company and its customers, the lighting company may be said to be engaged in illuminating engineering work. Such activity, however, forms but an insignificant part of the company enterprise. While its importance is more generally recognized than formerly, such illuminating engineering of necessity is restricted very largely to the application of existing knowledge. rather than to the development of new knowledge in the field of illumination. The lighting company applies developments, and it is only natural that the art of illumination (art in the sense of application of knowledge) should be emphasized in lighting company illuminating engineering, and that the development of the science of illumination should receive but little impetus therefrom.

Thus associations of lighting companies are interested in the practise of illuminating engineering. And the discussion of improvements in lighting practise is a feature of increasing interest in the meetings of such associations. There are, however, other aspects of illumination not properly included in these proceedings which may not be neglected if the science and art are to be developed properly.

The problem of illuminating engineering may be summed up in a practical way as follows: Illumination must be pro-

vided with a view to rendering visible the things which it is desired to have seen. The illuminating engineer, in studying each problem, must ascertain what it is desired to have seen, and for this purpose, must inform himself concerning the requirements and the viewpoints of those who are furnishing the lighting, and those who are expected to see by its aid. In a machine shop, the illuminating engineer must put himself in the place of the mechanic, and must so design the installation that the mechanic can see the surfaces upon which he works and can see to apply tools properly. In the building in which the architect has sought for certain effects, the illuminating engineer must provide light with which to display, in a proper way, those surfaces and ornamentations which the architect desires to have seen. Briefly, the illumination must be designed for the particular purpose for which it is to be used.

The illuminating engineer must not only render visible the things which are to be seen; he must also establish and maintain hygienic conditions for the eyes and body. It must be practicable to see without injury to the eyes, and without discomfort. It may be that in the proper discharge of this part of his functions, the illuminating engineer may be called upon to go beyond his strict province, and to influence conditions other than those of illumination. For example, he may have to urge the use of suitable paper in schoolbooks.

The illuminating engineer must not only render visible the things which are to be seen, and make vision possible under hygienic conditions; he must also consult esthetic requirements, and conform to correct principles of architecture and decoration, thereby satisfying discriminating

taste. He must choose fixtures and lighting equipment which will be in harmony with the character of the installation and the decorations. He must so distribute, diffuse, and modify the color of the light,

as to produce pleasing effects.

These three requirements having been met-a tasteful and satisfying installation having been provided, with which it is possible to see with comfort the things which it is desired to have seen—the illumination may be said to be effective, and the work of the illuminating engineer may be said to have attained one of its primary objects. There remains the important and fundamental consideration that these things must be accomplished with reasonable economy. If large energy consumption must be incurred in order to make the installation effective, the illuminating engineer does not hesitate, for the installation is efficient nevertheless. cannot be efficient unless it achieves the purpose for which it is designed, and large energy consumption or high maintenance cost does not necessarily imply inefficiency. But it is found usually that there is ample opportunity for the expertness of the illuminating engineer to manifest itself in so designing the installation that it shall be effective in accomplishing the purpose for which it is intended, while reducing the cost very materially below that which would be required in order to secure the same lighting effects by inexpert methods.

Here, then, is the illumination art in a nutshell: To render visible the things which it is desired to have seen; to establish hygienic conditions for vision; to conform to esthetic requirements; and to accomplish these things with reasonable

economy.

It is conceivable that in designing a building those responsible might desire to provide an illuminating equipment which should be as nearly as possible perfect. Having investigated the problem, it might be determined to retain a group of specialists in the various professions which are concerned with the problem. It is conceivable, then, that there would be retained an engineer who is conversant with the properties of illuminants; a contractor who would install the equipment; a fixture designer competent to design or select suitable lighting fixtures; a glass

expert competent to produce such quality of glassware as it might be desired to employ in the installation; a physicist qualified to apply optical laws in the design of reflecting and diffusing surfaces; an accomplished decorator; a psychologist and an opthalmologist, who would pass upon the conditions from the viewpoint of vision conservation. These specialists, in co-operation with the architect of the building, would meet to decide upon plans for providing illumination. The viewpoints of each would be important to an extent that would make neglect seriously prejudicial to the success of the lighting installation. Each specialist might be expect to know, or think that he knows, what kind of illumination is necessary in order to fulfill the requirements from his viewpoint, but he would not know how to obtain such illumination. Furthermore, each specialist would be more or less ignorant of the illumination requirements, judged from the standpoints of the other members of the committee. Whether or not such a committee of experts would be able to agree upon a particular plan for illuminating the building, can be left to the imagination.

The well-qualified illuminating engineer must be informed in regard to the underlying principles of each science and art which would be represented by a specialist on our hypothetical committee. It is too much to expect that he should be

an expert in each of these lines:

"A man so various that he seems to be Not one, but all mankind's epitome."

He must, however, have sufficient knowledge of the fundamentals, and sympathy with the aims of each of the sciences and arts involved, to bring his work into harmony with them, and it may be noted that he should be better qualified than would the committee, to produce a well-balanced design, because his knowledge of the other phases should enable him to give each its proper weight in final consideration of the subject.

To state the function of the illuminating engineer, is to indicate the work of the Illuminating Engineering Society. It seeks to be the forum where specialists, engaged in each of the sciences and arts which enter into illuminating work, can

meet for study and discussion of the problem, exchanging views, learning from one another, and endeavoring to establish correct principles upon which illuminating engineering must be based. Once established, through the meetings and Transactions of the Society, these principles are quickly disseminated among the membership, and are applied in the practical work of illuminating engineers. When proven beyond peradventure, effort is made to make them known to the public, as in the case of the DEMONSTRATION OF LIGHTING EFFECTS.

It is a peculiarity of illuminating engineering that the demands are for the highest technical knowledge and skill applied in the common walks of life; that success or failure affects closely the people in their ordinary occupations. The most technical discussion of subjects pertaining to illumination is likely to have a practical application, of interest to the man in the street. It is the purpose of this presenta-



Courtesy Photographic Department The New York Edison Company. ROOM 2. ROOM 3. FIG. I .- SHOWING IMPORTANCE OF SHADING LAMP.

ROOM I.

Illumination Primer, recently published by the Illuminating Engineering Society.

This brief discussion should serve to indicate the character of the Illuminating Engineering Society. There is a real need for an organization which shall make a specialty of illumination, developing the science and the art so that it may be applied by lighting companies and others. I believe that an impartial study of illumination developments of the past six years will lead to the conclusion that the Illuminating Engineering Society has justified itself by its achievements and by its present status.

This introduction having been accomplished, let us proceed to a discussion of certain phases of the illumination of interiors.

tion to indicate in a non-technical manner some of the features of the illumination of interiors which have been studied, and upon which we have some information as a basis for practise.

If a room be illuminated by a bare lamp (Fig. 1, right), the results are unsatisfactory for a number of reasons. In the first place, the walls receive the major amount of the light produced and the portions of the room in which the light is more likely to be utilized, are inadequately illuminated. The light source is unattractive, and, when within the field of vision, is annoying, if not actually injurious to the eyesight. This latter effect, included under the name of glare, is very noticeable in the illustration, where the lamp is at the center of the field of vision.

The temptation to dear with various types of interiors and to undertake studies of color were resisted. Only one type of interior, and that in its simplest form, was considered, time lacking for a more extended discussion.

The suite of miniature rooms was constructed under the supervision of Mr. W. F. Little and was operated under his direction by Messrs. H. Bardwell, M. D. Beuick and W. Ihlefeld, all of the Electrical Testing Laboratories, New York.

For the lecture upon which these notes are based, miniature rooms were constructed. These were 4 by 4 feet and $3\frac{1}{2}$ feet high. Wall decorations, as well as lighting equipments, could be altered readily. With one or two exceptions, lamps were so operated as to produce 64 lumens in each room. This permitted of comparison of various lighting systems on an equitable basis. With this demonstration equipment a wide variety of lighting effects could be produced and approximately forty were projected. Time limitation, however, restricted those actually presented to twelve, which are here illustrated by photographs available through the courtesy of the New York Edison Company.

The temptation to deal with various types of interiors and to undertake studies of color were resisted. Only one type of interior, and that in its simplest form, was considered, time lacking for a

and the effect is exaggerated beyond that which would be experienced by occupants of the room.

If the lamp be shielded from view (Fig. 1, left), conditions are much improved. Much of the discomfort and annoyance disappears. While the distribution of light on surfaces seen within the 100m is not changed materially, yet everything can be seen more distinctly. Observe, for example, the vertical stripes upon the wall-paper. Beginning near the

tor may be ascertained by reference to photometric tests of light distribution, which practically all manufacturers of reflectors are today prepared to supply with their wares. Perhaps in no branch of illumination have such great strides been made in the past ten years as in the design of reflectors in particular, and lighting auxiliaries in general.

It has been noted that the bare lamp distributes but a small proportion of the light downward. In room No. 2 (Fig.



Courtesy Photographic Department The New York Edison Company.

ROOM 3. ROOM 2. ROOM I.

FIG 2.—SHOWING VARIETY OF LIGHT DISTRIBUTIONS WHICH MAY BE OBTAINED BY THE USE OF CRDINARY REFLECTORS,

floor, trace a vertical stripe which is at some height, almost, if not quite in line with the lamp in room No. I (to the right). It will be noticed that as the gaze approaches the vicinity of the lamp, it is difficult to see the stripe, and that when level with the lamp, the stripe disappears entirely. In room No. 3 (to the left) in which the lamp is shielded from the eye, the corresponding stripe may be distinguished when looking just past the lamp and screen.

One of the important functions of a reflector or other lighting auxiliary is to thus shield the lamp from view, by interposing between it and the eye, either an opaque or a translucent medium. This is accomplished in room No. 2 (Fig. 1, middle).

But a reflector should fulfill other, equally useful, purposes. In shielding the lamp from view, it may also be made to direct a considerable proportion of the light where it can be utilized to best advantage. Much study has been given to this aspect of the problem, and the performance of any standard type of reflec-

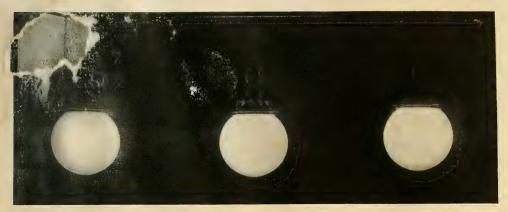
2), a reflector is employed which redirects downward a goodly proportion of the light, illuminating the card below it much more brightly than would a bare lamp. In room No. 3, this re-direction of light is effected in such a way as to concentrate a large proportion directly below the lamp, thereby illuminating the card to a brightness which is about twice that of the card in room No. 2, which was considerably brighter than the card in the room where no reflector was used.

In room No. 1, as now equipped, a reflector is employed which has been designed without regard to optical laws, and which, though looking like a prismatic reflector, has in fact almost none of the qualities which characterize such glassware. It accomplishes little in the way of redirection of light, while affording but an ineffectual protection for the eyes against brightness of the filament. It absorbs a certain amount of light without rendering any adequate return in improvement of conditions.

In the three rooms there is illustrated the range of practicable accomplishment in the employment of reflectors, if we omit opaque reflectors, which would not be suitable for employment under such conditions. In room No. 1, general distribution of the light throughout the room; in room No. 2, effective re-direction of much of the light downward, largely increasing the intensity on the table plane, though illuminating the walls and ceiling brightly enough to avoid the appearance of dimness. In room No. 3, the concentration within a small area beneath the lamp is

The use of an incorrect shade holder or of an improper lamp distorts the distribution and usually detracts from the appearance and usefulness of the lighting unit.

In reflectors, as well as in globes and other forms of glass lighting auxiliaries, the degree of optical density is important, affecting both the performance and the appearance of the glass. This is an important feature to be considered in selecting glassware. In the now rather common forms of display street lighting, which



Courtesy Photographic Department The New York Edison Company.

LIGHT. MEDIUM. DENSE.
FIG. 3.—SHOWING IMPROVED APPEARANCE WHEN GLASSWARE IS DENSE ENOUGH TO CONCEAL LAMP.

very marked, this being effected by taking from the walls and from the table plane near the walls a portion of the light which falls upon them in room No. 2, and concentrating it upon or near the table. The relative intensities of light distributed downward may be judged from the floor brightness.

The correct design of a reflector to accomplish a given purpose, involves the application of well-known optical laws. With prismatic glass and mirror types of reflectors, a wide variety of distribution may be obtained. With opal or phosphate glasses, such as that in room No. 2, the possibilities of securing high concentration are rather more limited, though with this one exception these, too, may be designed to produce practically any distribution likely to be required.

In achieving the particular distribution which characterizes a given reflector, it is important that the light source be correctly located with reference to the reflector.

utilize clusters of tungsten lamps in globes, very displeasing effects are sometimes encountered, due, first, to the nonuniformity of the globes, and, second, to the insufficient density which makes the location of the lamp apparent, instead of rendering the whole surface of the globe equally bright, making it appear a ball of light. Much of the lighting glassware in use in residences a few years ago, and it is to be feared even to-day, consists of etched or frosted crystal glass, which serves chiefly to give the fixture a somewhat finished appearance. It neither directs sufficient light usefully to make it efficient, nor conceals the light source sufficiently to make it attractive or of value in protecting the eves.

In Fig. 3 there is a globe of crystal glass, roughed inside, a light opal globe, and a denser opal globe. The last presents a better appearance without involving serious sacrifices otherwise. The light absorptions of these balls are, respectively:

Frosted ball. 6 per cent. Light opal ball. 13 per cent. Dense opal ball. 22 per cent.
When employed in the miniature rooms shown in Fig. 2, the relative light intensities throughout the table plane averaged
Frosted ball. 100 per cent. Light opal ball. 106 per cent. Dense opal ball. 95 per cent.

In passing I wish to refer to the great diversity of lighting fixtures and glassware which are now available in standard types, awaiting selection. Practically all reflectors of ten years ago were opaque, and few were pleasing to the eye. To-day even in the reflectors where efficiency in light re-direction is the chief aim, pleasing appearance is the accepted order.

In the class of lighting auxiliaries in which decorative effect is the chief object a wide variety is available, and much of it is pleasing and tasteful. Unfortunately, however, such auxiliaries are characterized by inefficiency to an extent which appears rather unnecessary. It is probable that in the developments of the next few years we



Courtesy Photographic Department The New York Edison Company.

ROOM 3. ROOM 2. ROOM 1.

FIG. 4.—SHOWING APPEARANCE WITH VARIOUS WALL DECORATIONS.

ordinary requirements in interior illumination may be filled by lighting auxiliaries selected from those now upon the market. In regard to efficiency, most of the reflectors and globes which pretend to be efficient, accomplish their purpose admirably. In fact, so carefully has this element of the question been studied, that an inefficient reflector cannot to-day be successful unless it has some compensating advantage, which renders it superior for some purposes in spite of its inefficiency. I recently went through the interesting experience of making a comparison of the standard types of reflectors which were upon the market ten years ago, and comparing them with types now available. In regard to efficiency, the improvement has been very marked. Absorptions of 10 to 20 per cent. now rule, where ten years ago absorptions of 25 to 40 per cent. were typical for reflectors of substantially similar light distribution characteristics. Improvement in the quality of reflecting surfaces has gone hand in hand with improvement in the design of the curvature of such surfaces. As in efficiency, so in appearance. Most of the

shall note a strong tendency to improve the efficiency of some types of decorative reflectors, without interfering with their decorative qualities.

The influence of room decoration upon the amount of light required to illuminate a room properly is very marked; or, stated otherwise, with a given amount of light produced in a room, the effectiveness of the illumination is largely influenced by the character of the decorations. Considering the simple case of a bare lamp, employed to illuminate rooms having light, medium and dark walls respectively, we may note a number of interesting effects, (Fig. 4). In the first place, the illuminated card on the table in room No. 3 appears brighter than the cards in the other rooms. It must be apparent that the card cannot be brighter because it receives light from the lamp and the ceiling only, while the card in room No. 1, for example, receives light from the corresponding light sources and ceiling, which is enhanced considerably by light reflected from the walls. The card in room No. 1 is actually 30 per cent, brighter than the card in room No. 3. That it does not so appear is an example of the effect of contrast, which in illumination is a very important fundamental. A corresponding comparison may be made by observing the upper part of the wall in each room, where again the white paper appears brighter in room No. 3 than in the other rooms. Though actually not so bright as the white surface in rooms Nos. 1 and 2, these surfaces appear brighter in room No. 3 in comparison with the dark wall-paper to

the light is utilized, the other requirements being that the ceiling and walls shall be illuminated sufficiently to make the effect pleasing. When reflectors are used, the lighting effect of ceiling and wall decorations is reduced greatly, if the reflectors are concentrating in character, and reduced slightly, if they distribute the light rather broadly about the lower part of the room.

The brightness of walls is an important element, affecting ocular comfort probably



Courtesy Photographic Department The New York Edison Company.

ROOM 3. ROOM 2. ROOM 1.

FIG. 5.—SHOWING APPEARANCE WITH VARIOUS WALL DECORATIONS.

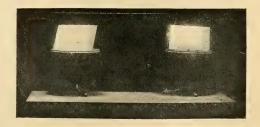
which the eye naturally adapts itself more or less.

In room No. I portions of the furniture which are but slightly illuminated, as legs of the table, stand out distinctly, being silhouetted against the light rear wall. In room No. 3 so small is the contrast between the rear wall and the dimly lighted portions of the furniture that it is difficult to discern the latter.

The glare due to the exposed light source is more serious in room No. 3, due to the larger contrast between the light source and the walls. Shadows of the furniture against the walls are very prominent by contrast in room No. 1, in spite of the fact that the shaded areas are more brightly illuminated by light which is generally diffused within the room.

In considering this photograph, it should be remembered that no light-directing auxiliary has been employed, and that therefore a larger proportion of the light falls upon the walls than good practise would dictate, if we except the darker room. In most installations it is desirable primarily to secure the proper illumination of the lower part of the room, where

more seriously than the illumination of the table plane. Generalizing, it is probably the best rule to avoid extremes of wall decoration, whether they be light or dark. If the walls are of high reflecting power, it is important to so direct most of the lighting that the amount permitted to fall upon the walls will not render them so excessively bright as to be trying to the eyes. The illuminating engineer cannot control wall decorations, but he can control the light produced within the room,



VIEWED FROM DIRECTION IN WHICH GLARE IS

NOT APPARENT.

VIEWED FROM DIRECTION IN WHICH GLARE IS

APPARENT.

FIG. 6.—SHOWING GLARE DUE TO SPECULAR RE-FLECTION FROM GLOSSY SURFACE. and can so direct it as to secure the best effects.

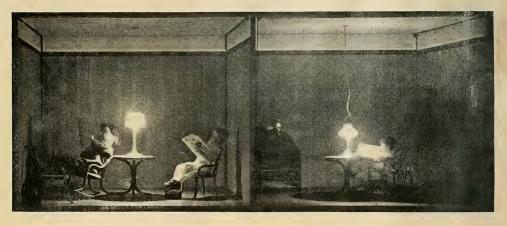
In the next photograph a reflector which directs the light downward rather

largely is shown.

This detracts from the brightness of the upper portions of the walls, the change of course being most apparent in room No. 1, where, due to the relatively high reflecting power of the wall-paper, the wall was brightest in the last photograph. The lower portions of the walls are somewhat brighter than when bare lamps were employed. Due to the better lighting of the floor, the lower portions of the table and chairs, which with the bare

the table plane. It may be argued as the corollary of this, that when the walls are dark and incapable of augmenting the table plane illumination materially, the use of reflectors for that purpose is all the more important.

We have discussed the effect of glare due to the presence of a bright light source within the field of vision. This effect would be almost, if not quite as disturbing, if instead of having a lamp within view, an image of the lamp were to be seen in a mirror. In that event, the effect would be due, not to the presence of the light source, but to specular reflection of the light from the mirrored surface. It is



Courtesy Photographic Department The New York Edison Company.

GOOD READING VERY UNDESIRABLE UNDESIRABLE READING POSTURE.

POSTURE. READING POSTURE. POSTURE.

FIG. 7.—SHOWING MANNER IN WHICH A TABLE LAMP MAY BE USED.

lamps could hardly be seen, are now slightly illuminated. With this installation the effect of the ceiling and walls is lessened, because a smaller amount of light is permitted to fall upon them reducing their illuminating power. That is to say, when a suitable reflector is employed, the table plane illumination intensity is more nearly independent of reflection from ceiling and walls, and instead of relying upon the latter for assistance in producing useful illumination, the problem is simplified to one of rendering the walls bright enough to produce a cheerful appearance.

It has been shown in the above that the ceiling and wall decorations, when light in tone, may be of material assistance in increasing the illumination intensity on

perhaps unfortunate that most artificial surfaces which we are likely to view are sufficiently glossy or polished to partake in some measure of the qualities of a mirror; that is, to reflect light specularly. Some surfaces which are very mat and free from gloss, diffuse the light so generally that the specular element of the reflection is immaterial for most purposes. But in most paper employed in books and magazines, there is a considerable element of specular reflection, and this characteristic is responsible for much of the difficulty which demands adroit handling by the illuminating engineer in utilitarian lighting.

Referring to the demonstration cards (Fig. 6), you are asked to note that the

paper and letter on the right half of each have glossy surfaces, while those on the left have diffusing surfaces being almost totally free from specular reflection. On the right half, one may see, when in line with the direction of the reflection, a distorted image, or a number of distorted images, of the light source, much as though he were viewing the source through a very imperfect mirror. On the left it is noted only that the surface is illuminated and no trace of an image of the light source may be seen. From all positions the letter on the left half of the card may be seen. From a particular direction (right photograph), that upon the right half of the card can be seen only with great difficulty, if at all, because it is viewed from the direction in which the glare is manifested.

No small part of the dissatisfaction with illumination installations is due to this effect of glare from observed surfaces. The statement may be ventured also that no small part of trouble with eyes is traceable to the same source. There are three remedies: One is, to eliminate glossy surfaces wherever possible; particularly is this important in schoolbooks, and it is very gratifying to know that serious efforts are being put forth with a view to regulating this matter. The second remedy is to reduce the brightness of light sources as much as practicable by passing the light through a diffusing medium of large area, or by reflecting it from a diffusing surface of large area, in order that when specular reflection from an observed surface is encountered, the brightness of the light reflected may be so low as to minimize the difficulty. The third remedy is to so locate light sources, or to so locate the illuminated surfaces and adjust the position in working or reading, that the direction in which light is reflected specularly shall not be toward the eyes. All three of these possible remedies should be kept in mind and applied wherever practicable, and any one, or a combination of a part of each of the three can be made effectual in reducing the trouble to a point where it is not serious. The growing appreciation of the importance of this element of illuminating engineering work has been the distinguishing feature of the past two years in the illumination field.

The oil lamp has in recent past years been the standard of comparison for artificial illumination. Even to-day it is traditional among oculists that there is no artificial illuminant which yields a light so free from detriment to the eyesight as does the oil lamp. It is therefore of interest to note some of the conditions under which the oil lamp has been used.

Being essentially a small illuminant, and both self-contained and portable, it was natural that it should be placed close to the object viewed. This entailed locating it more or less on a level with the eyes, and so near to the observer that shielding the former became a matter of natural course. In that fact is to be found the reason for the development of the oil lamp shade. Given a small illuminant, shaded for the protection of the eyes, there was no condition under which visual difficulties could be experienced unless it were attempted to read with the book in the illuminated zone near the lamp base, with the reader facing the lamp (Room 1). Under such conditions, glare due to specular reflection from the paper might be detrimental to vision, in which case it would be so immediately apparent that instinctively the reader would shift his position or the lamp slightly, in order to avoid it. With light from this single light source incident upon the page from a direction which would not result in serious glare from the paper, and with the flame shielded from the observer's eyes, the conditions for reading or other work were comparatively good. At the same time, the old oil lamp was well adapted to the illumination of a book by light from over the reader's shoulder (Room 3), one of the best positions for reading. It was in the comparative freedom from misuse of the oil lamp, and the conditions which its employment made natural, that the relative freedom from harmful effect was probably found, if such freedom did exist under those conditions, which is a point that has not been established. Of course, no matter how favorable conditions for vision may be, it is difficult to prevent a certain amount of carelessness or perversity in the use of the light.

(Concluded in January issue)

The Electric Lighting Equipment & Automobiles



By J. R. Colville

With the improvement of the mechanical features of the automobile, there naturally arises a demand for a more luxurious equipment. What the public demands the public gets and manufacturers are now supplying their cars fully equipped with electric starters, electric lights, and other accessories which tend to minimize labor.

The magneto system of ignition, while comparatively modern, is so well known that it needs no description here, but with the growing demand for electrically lighted cars, generators of suitable types have been developed. These are almost universally used in conjunction with storage batteries, the latter floating on the line when the engine is running.

One system utilizes a shunt wound magneto controlled by a centrifugal governor which operates a rheostat arm, cutting in more resistance as the speed increases.

There are on the market generators having a shunt winding and a series of magnet controlling a carbon rheostat, and also shunt machines having intermediate brushes or poles.

Another means of control consists of a differential winding and ballast coils. These ballast coils are wound of wire whose resistance increases very rapidly beyond a certain temperature corresponding to normal operating current, thus giving an automatic adjustment.

Still another scheme to obtain constant voltage is the use of a centrifugal clutch or friction wheel which operates against

a spring in such a manner that the dynamo speed is constant, regardless of the engine speed.

Of course when the engine is standing still the generator can supply no current, so there must be a means of disconnecting from the battery circuit, and a means of connecting in again when the engine comes up to the required speed. This is accomplished by several methods, among which are the following:

By the shunt voltage and series lock automatic switch, in which the shunt coil closes the circuit, cutting in the series coil which locks the switch, holding it against the bumps and jolts of the machine. This series coil also acts as an automatic release, for should the generator voltage drop below the battery voltage then the battery would send current through the series coil in the opposite direction, thus neutralizing the magnetism of the shunt coil and allowing the switch to open.

By centrifugal weights which operate on the same principle as the fly ball governor, opening or closing the circuit.

By a mercury cup which is also centrifugal in principle, the mercury closing the circuit as it flies to the outside edge of the containing vessel.

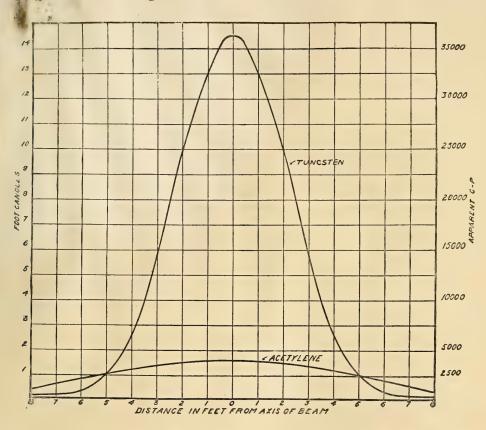
By the ordinary fly-ball and arm device. Any of the above methods have been used in actual practise and can be adjusted so that the dynamo carries the full load for all engine speeds above fifteen to eighteen miles per hour.

When the need for some automatic

means of starting the engine began to be imperative, engineers took steps to design a dynamo which could be used to light the machine, furnish the current for ignition, start the engine under any conditions and at the same time be light and compact. The result has been exceedingly good. There are two or three types in use at the present time. One form is rigidly mounted on the engine and is con-

the speedometer lights are three volts each and are usually connected in series, thus allowing the entire system to operate on six volts.

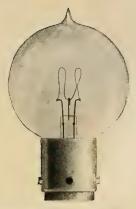
The power and general efficiency of self-starters are remarkable. They have sufficient torque to start the engine under almost any condition and in case of a breakdown may be used to drive a heavy machine for several miles. The recent



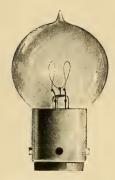
nected to the shaft through gears: in another device the armature is designed of sufficient size and weight to serve as the flywheel. Some of these generators are designed to deliver current at twelve volts as dynamos and to operate on twenty-four volts when used for starting. This is not to be recommended as the batteries when charging are thus connected in parallel, and when starting in series. The lamp circuits are led off so as to supply the required six volts to the head, side and tail lamps. The rear and

improvements in storage batteries have had a great deal to do with the success of these dynamos and great care should be used in their selection.

As regards the lighting of automobiles, electricity has proved its superiority over all other illuminants in many ways. The automobile type, drawn wire tungsten lamps are admirably suited for this purpose. They are remarkably rugged, standing up well under the hard usage to which they are subjected. They burn at an efficiency of approximately one watt per



TUNGSTEN SIDE-LIGHT, I IN. DIAM., 13/4 IN. LONG. FULL SIZE.



TUNGSTEN SIDE-LIGHT, 1¼ IN. DIAM., 17% IN. LONG. FULL SIZE.



TUNGSTEN HEADLIGHT, 2 I-16 IN. DIAM., 3 IN. LONG. ONE-HALF SIZE.

candle and g a light of a superior quality.

The heading it lamps furnish a practically point so are of light which is essentiated.

cally point so ce of light which is essential in the use of a parabolic reflector.

The curves shown in Fig. 1, give the results of a series of test using acetylene lights and tungsten lan. The gas headlights used were of the est design having in addition to the regular reflector an annular reflecting seriace between the flame and the front of the lamp. The burners were of the common variety rated at 5% cubic foot per hour. These burners each actually consumed 1.07 cubic feet and gave an average horizontal candle-power of 29.8.

The electric headlights were of the usual parabolic type, the actual diameter of the reflectors being 8½ inches. The lamps used were tungsten headlight lamps of 21 candle-power, consuming 21 watts.

Readings were taken 50 feet from the lamps across the plane of the axis of the beams, in each case at intervals of one foot. Determinations of illumination in footcandles were made and the candle-power computed, the results are shown in the curves. The two electric head lamps were mounted 30 inches between centers.

It will be noted that the electric lamps give a much closer distribution and do not project light where it is not necessary. The illumination ahead is about ten times as great with the electric headlights as with gas.

Table 1, gives the complete list of tungsten automobile lamps with their corresponding wattage, candle-power, size,

Electric light on a car not only lends refinement to the machine on which it is used, but it possesses advantages that are essential to luxury and comfort. simple pushing of a button produces a superior illumination at any and all times regardless of the rate at which the car is moving. The annoyance of climbing out in the rain and mud to light lamps is eliminated. A portable safety trouble lamp removes the danger incident to the use of matches around inflammable liquids and vapors. Efficient, adjustable reflectors allow of the concentration or spreading of the light as desired. Any adjustment of the lamp can be absolutely maintained and is not affected by vibration due to the roughest road, nor is it por the that the lamp be extinguished by the wind. Results of photometric and actual service tests have proved electricity to be superior to any other illuminant for automobile lighting. Receive provements in tungsten drawn-wire aps have been largely responsible for a great development.

Automobile manufacturers after thorough conservative tests are adding this system of illumination to their standard equipment.

The indications at present are that electricity will play a greater and greater part in automobile construction and equipment and just what the outcome will be is a question which is impossible to answer.

TABLE 1.-TUNGSTEN (ELECTRIC) AUTOMOBILE LAMPS.

		Mean	Amperes	Esti-		
		Horiz'ntal	at	mated	Bulb	Over all
	Total	Candle-	Rated	Hours	Diam. in	Length
Type.	Watts.	Power. Volts.	Voltages.	Life.	Inches.	Inches.
4	9	9.14 6	1.5	300)		
*Auto Headlight 31/2-inch Round	12	12.3 6	2	300 ($1\frac{1}{2}$	2%
	15	15.2	2.5	300 €		
	18	18.3	3.0	300 J		
	15	15.2	2.5	600		
*Auto Headlight 21/16-inch Round	1 18	18.3 6	3.0	600	$2^{1}/_{16}$	3
, 1	21	21.3 6	3.5	600	,	
	24	24.4 6	4.0	600		
%-inch Tubular (Special cap base each end)	24	4.06 6	.83	300)	5%	21/16
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	7.5	6.1 6	1.25	400 €		
Rear and Speedometer Series burning	1.25	1.02 3	.42	300		
	1.8	1.52 6	.31	300	3/4	11/4
‡Auto Tail-light %-inch Round	2.5	2.03 6	.42	300		
	3.75	3.1 6	.63	300		
	1.8	1.51 6	.31	300		
	3.75	3.1 6	.63	500 }	1	13/4
‡Auto Side-light Round	5.75		.85	500 j		
	3.75	3.1 6	.63	500		
	7.5	6.1 6	1.25	500 }	11/4	1%
	10	8.2 6	1.70	500		
‡Pear Shape	5	4.06 6	.83	500 7	1	115/16
	7.5	6.1 6	1.25	500 \$		
#Side Light (Pear Shape)	7.5	6.1 6	1.25	500	11/8	$2\frac{1}{4}$
	10	8.2	1.70	500 (
* Candalahua sanam an harrant and dat	there the			,		

* Candelabra screw or bayonet candelabra bases.

‡ Standard miniature screw, candelabra screw or bayonet candelabra bases.

Musical Mantles

By Dr. ROBERT GRIMSHAW.

The great Messe of Annual Fairs in Leipzig is one of the few such which remain in Europe, and it is still one of the "sights" although modern methods are commencing to crowd out the more primitive; and in this connection advertisement is proving equal to the occasion. One of the features is the street parade. In the line of illumination the manufacturers and dealers seem as a rule to be suffering from a lack of originality in design and execution, which perhaps is due to the character of the articles offered. year, however, one firm, the latest in the line of incandescent mantles (or "stockings" as they are called in German-speak-

ing countries) was represented by a set of such articles, about five feet high and wide enough to take in a man. Suitable openings were left for the arms of each "motive power" and of course a hole through which he could see his way. The arm-holes could on no account have been omitted, for they enabled each person to strike a metal plate. These plates were tuned in accord like the bars of a xylophone, and the "artists" inside the mantles" played upon them popular airs-among others the well-known song, "Deutschland, Deutschland über alles" (Germany, Germany for everything)



Re-lighting the **N**osbraü

By W & Martin

The old Hofbrau at Cleveland was built some years ago and has always been a very popular restaurant, due to the broadminded policy of Mr. Buse, the manager. When the building was constructed large German hall with heavy beam trusses and dark wood furnishings. Here again these large massive fixtures were used for illumination while a great number of bracket lanterns were arranged



he carried out the strict old German architecture in every detail. The buffet was modeled after an old German interior and heavy dark wainscoting and furnishings were used throughout, light being furnished by old wooden and metal lanterns of a very good design consistent with the architectural surroundings. The main dining room was also a reproduction of a

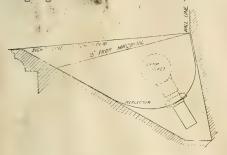
over the tables on each side of the room.

Mr. Buse realized about a year ago that it would be advisable to change the main dining room and bring it up-to-date. With this end in view the kitchen was moved to the basement and the size of the dining room nearly doubled.

The old room, of course, had a very dark and gloomy appearance so character-

istic of the German type of rchitecture. This appearance was also accentuated by large art glass windows on the east and north ends of the room.

In his new interior Mr. Buse wished to entirely avoid the effect and had his architects work up esigns for an interior that would be by all from the architectural standpoint d, while not entirely losing sight of the German idea, would



COVE LIGHTING ARRANGEMENT.

still convey an atmosphere of cheerfulness.

The result is one of the finest dining rooms in Ohio.

The lighting of the Hofbrau is indirect, not a light source being visible. Both the main room and side room are lighted by small sized lamps concealed in coves at the base of the curvature of the ceiling. This was determined upon since a large number of small lamps gives far better results than a small number of large ones when used in this way. The entire ceiling area is lighted to the same intensity, there being no streaks of light as might

possibly result were the units spaced farther apart and of larger candle-power. Two hundred-25 watt clear bulb tungsten lamps are used in connection with special equipment, and in the main dining room.

In the side room ninety-six reflectors each equipped with two 15-watt lamps are employed concealed in the cove.

Over the art glass skylight are placed a number of distributing type of reflectors. Very little illumination is afforded by these lights. They are used simply to light up the skylight to the same intensity as the rest of the ceiling thereby adding considerably to the artistic appearance of the interior.

In the cove on the orchestra stage at the north end of the room are eight reflectors and it can be seen that the illumination here is much stronger than elsewhere. No lights are used on the music stands, the indirect illumination supplying all that could be desired.

All the lights in both the main and side dining rooms are on three distinct circuits, i, e., every third light is on the same circuit. In this way three different intensities of illumination are possible.

Every detail of importance in connection with the Hofbrau installation was given due consideration, and the final result has more than justified this care.

Patrons of this restaurant have put the stamp of approval on the system of illumination; this has been established by the increased popularity and patronage.

TESTING THE PERMANENCE OF COLORS

It is well known that besides the visible rays in sunlight, the invisible chemical rays, the ultra-violet rays, tend to produce chemical effects, apparently because they lead to resonance of the electrons within the atom. It is these rays which cause snow blindness, sunburn and even, it is thought, the marking of small pox. They are also largely responsible for the deterioration in color of dyed materials. In a recent number of Science Progress Mr. J. S. Dow mentions this fact, and alludes to the new quartz tube mercury vapor lamp, which is very strong in these rays.

So well is this effect recognized that the carpet manufacturers of North Germany are said to use the new quartz lamp as a means of testing the permanence of their dyes. Formerly they used to send the goods to the sunny south, where there was abundant bright daylight, to which the materials were exposed for weeks at a time. But now it is possible to do by artificial light in a few days what it formerly took weeks to accomplish. And there is also the advantage that this can be effected irrespective of climatic conditions.

TECHNICAL

ELIMINATION · OF · COLOR · DIFFERENCE IN · THE · PHOTOMETRY · OF · INCANDESCENT LAMPS · MEANS · MULTI-VOLTAGE · STANDARDS

BY DAVIS H.TUCK

The unit of intensity of illumination, mean horizontal candlepower, in the United States and England is based upon the performance of carbon and tungsten lamps when operated at a fixed efficiency, the carbon lamps burning at an efficiency of four watts per mean horizontal candlepower and the tungsten lamps burning at an efficiency of 1.50 watts per mean horizontal candlepower.

When gem lamps or metal filament lamps, burning at an efficiency other than 4 watts, or 1.50 watts per mean horizontal candlepower, are to be compared with primary standard lamps or duplicates of primary standard lamps, the difference in color resulting from the different operating efficiencies makes the process of accurate comparison very difficult. When different observers make photometric measurements on lamps which operate at an efficiency different from that at which the primary or secondary standards are calibrated, different results are obtained and experienced observers will repeat their values from day to day. With this in view it is readily seen that to obtain accurate candlepower values for such lamps it is necessary for a large number of experienced observers to make independent measurements, and the average of such a series of measurements taken as the true candlepower values of the lamps.

Several combinations have been more or less successfully used to eliminate the difference in color of the light which falls on either side of the photometer screen, and such combinations are indispensable when a large number of lamps, burning at an efficiency different from that of the standard lamps, are to be accurately calibrated in a limited time. The flicker

photometer is used in some laboratories to eliminate the color difference between the standard and the test lamp but the reliability of such data is questionable. Colored glass placed in the path of the light is also used to reduce the light which falls on either side of the photometer screen to the same color. Difficulty arises from the use of colored glass screens from several sources. A very large number of glasses would have to be calibrated to obtain a color match with all types of lamps and such a calibration would involve an enormous amount of labor. The question of permanency of the density of the color screens arises and this uncertainty necessitates frequent check measurements. There is also the possibility of breakage and the inconvenience of replacing any particular glass.

By the adoption of the procedure outlined below it is possible to make the comparison of lamps operating at different colors at some convenient time and once for all and to make all subsequent comparisons under the favorable conditions of a color match.

Select a group of tungsten lamps which are so constructed that the filaments are strongly anchored, and at the same time the current comes to a steady value in less than forty-five seconds after the voltage is applied.

Select four voltages which will operate these lamps at different efficiencies between 4.00 and 1.50 watts per mean horizontal candlepower. At these voltages let five or more experienced observers make at least nine independent candlepower determinations, using carbon or tungsten reference standards.

In the table below are given the candle-

power and corresponding voltage values of a 60 watt tungsten lamp.

	_	
LAMP NO.	160 WATT	TUNGSTEN. VOLTS 107.5
		Mean Horizontal
Obser	rver .	Candlepower,
A		46.84
" B		47.10
C		46.80
Ĭ		46.77
F		
	11	The state of the s
	Mean	46.86
LAMP NO.		TUNGSTEN. VOLTS 98.0
	1 2 h m	. Mean Horizontal
Obsex		Candlepower.
Δ		34.23
i x		34.10
(34.21
1		34.08
E	C	34.12
		2117
		34.15
LAMP NO.	1GO WAT	T TUNGSTEN. VOLTS 85.0
01		Mean Horizontal
Obser		Candlepower.
P		19.60
J.		19.60
Ĭ		
1		
I	N	19.57
	Monn	
VARIA NO		T TUNGSTEN. VOLTS 71.0
BRAIF NO.	100 WAI	Mean Horizontal
Obse	rver	Candlepower.
	1	
Ė		9.85
- C		9.76
Ì		9.83
Ī		9.79
	Mean	9.81

sequent comparisons of test lamps may be made against these multi-voltage tungsten lamps as standards, when these standards are operated at such a voltage as will produce a color match with the lamps to be tested.

The procedure is the following:

PROCEDURE I.

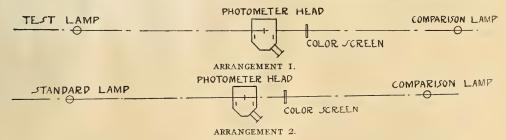
Adjust the voltage of the comparison lamp to give a color match with the test lamp when the test lamp is operated at the voltage at which it is to be standardized. If necessary insert a blue color glass between the comparison lamp and the photometer screen. See arrangement No. 1.

PROCEDURE 2.

With the voltage of the comparison lamp constant as found in procedure 1, and the color screen, if used in place, adjust the voltage of the multi-voltage standard lamps to give a color match with the comparison lamp. See arrangement No. 2.

PROCEDURE 3.

Use the multi-voltage tungsten lamps



If the logarithms of the voltage values be plotted against the corresponding logarithms of mean horizontal candle-power, the mean values in each case being used, the resulting curve will be a straight line. Such a plot made from the above data is shown in Fig. 1. If values are read off from the logarithmic plot and the numbers corresponding to the logarithms plotted into a direct plot a candlepower-voltage curve, shown in Fig. 2, may be accurately constructed. It will be noted that to construct such a curve from direct data would require a prohibitive amount of work.

When the candlepower-voltage curves have been constructed for a group of multi-voltage standard tungsten lamps all sub-

at the voltages found in procedure 2 as standards for comparison with the lamps to be tested.

When the photometer is designed to move the comparison lamp and the photometer head as a unit, it is advisable to use a carbon comparison lamp and in such a case it is necessary to use a blue color screen, as shown in arrangements I and 2, when high efficiency test lamps are to be calibrated. The glass, however, is kept in the same position throughout the entire calibration so that it is not necessary to know the transmission coefficient. The method outlined above has been found very convenient when groups of lamps of the same efficiency are to be accurately calibrated in a limited time.

EDITORIAL

THE EDITOR DOES NOT NECESSARILY IDENTIFY HIMSELF WITH THE OFINIONS EXPRESSED IN CONTRIBUTED DELICATION GOOD LIGHTIN

IN APPRECIATION

The recognition extended GOOD LIGHTING these past few weeks by Architects, Decorators, Fixture Concerns, Central Stations and Gas Companies, is indeed an incentive to further the policy as inaugurated under the present new management.

We take this means of most heartily thanking those important interests who have so materially lent their support to the development of GOOD LIGHTING.

ARCHITECTURE AND "ILLUMINA-TING ENGINEERING"

Elsewhere in this issue of GOOD LIGHTING is reprinted some views expressed by Frank E. Wallis, as published in the Illuminating Engineer, London, upon his recent visit to that city.

The Editor of the Illuminating Engineer (London) states that "Mr. Frank E. Wallis is not only one of the best known architects in New York, but he is one who has special opportunities of becoming acquainted with illuminating engineering, having, among other important commissions, designed the National Electric Lamp Association works and laboratories at Cleveland, Ohio."

In our estimation, Mr. Wallis has very justly expressed himself as regards the relation of the "illuminating engineer" to and with the architect.

Mr. Wallis has been especially considerate of the "illuminating engineer" and his work and relations. Much more so than the average "illuminating engineer" usually evidences in his appraisal of the architect and his work. Such, however, might be expected.

There are reasons for knowing that if those primarily interested in the subject of light will approach its application and association with full respect and consideration for all phases involved, almost forthwith will the most powerful and valuable co-operation of the architecture extended.

It is not as aim in this editorial to set forth the shortcomings or qualifications of either the architect or the "illuminating engineer," but this words know, and may state, that the architect is upon light—natural and artificial—for the use mildings, and that he should make it his effort to calcal knowledge as regards possibilities of uses of modern illuminants, also natural light, and that such information can to a large measure, be obtained from broad-minded persons concerned in the use of light.

It is also evident that the lighting specialist (we feel that the title "illuminating engineer" is illogical and misleading) must recognize the fact that the architect is the master builder, and must of necessity have the supervision of all phases associated with the erection of buildings which he has designed; also that while the architect is naturally concerned in the utilitarian—and to an even greater extent than many uninitiated persons seem to feel—he is more concerned in obtaining effects which, in being in harmony with environments, and agreeable to the physiological sense, are obtained through the use of efficient illuminants and accessories, which permit of economic maintenance.

Further, that the architect's mission is one of opposition to depressing, monotonous, unattractive effects. He welcomes practical, unique, attractive applications of light, which reflect the personality of environments and business!

To any one conversant with conditions, it is known that the methods usually employed by the average so-called "illuminating engineer" have not bred proper respect in the architect's mind for the tremendously great and important subject of light, which subject usually has been so unfortunately presented as not only to not find favor with the architect, but to cause the architect to feel that the exponents of the subject of light are of an unintelligent, unco-operative order.

Such conditions must be eliminated before real co-operative progress can or will be made.

Fortunately, some lighting specialists, gifted with broad knowl-

edge of the subject in its entirety, have succeeded in getting to the attention of some architects, and, as a result of such co-operation, we now have some few examples of really worth while lighting.

If (and we now refer to all classes of buildings aside from the most commonplace) the lighting specialist is incapable of appreciating the ensemble to which the architect is working, then such person should confine his efforts simply to the physical means to the end when the end is definitely designated by the architect.

The architect, however, is desirous of who erating with the lighting specialist who can "feel" the effects sound for by him, and can, therefore, not only assist the architect in the physical work involved, but also in enhancing and extending the effects themselves.

Such, usually, has not been the work of the average 'Mandating engineer' as such. Consequently, the "illuminating engineer" has made very little advance with the architectural profession. In fact, in many instances, the "illuminating engineer" has bred disorder and distrust in the architect's mind.

The subject of light—natural and artificial—is not being properly served by "illuminating engineering" as is generally practised.

The service extended by Good Lighting (referred to on page 537 of this issue) is *not* "illuminating engineering."

The Good Lighting service is just what architects and others broadly and vitally interested have sought, but heretofore not found.

Investigate!

THE ILLUMINATING ENGINEERING SOCIETY OF GERMANY

In this issue of GOOD LIGHTING, a report of the foundation of the Illuminating Engineering Society of Germany is indicated. Our congratulations are extended to those responsible for this development, and our very best of hearty good wishes are extended the Society for a most successful life.

We cannot help but feel that the Society founded in Germany would be the more successful if conducted under a name more adequately expressing the work,—one which would permit of a common ground for all interests concerned, for the intelligent use of light is not restricted to what might be termed engineering.

PERSONALITY

Mr. Pembleton, of the Public Service Corporation of New Jersey, is appreciative of personality—he so expresses himself in his very interesting article printed elsewhere in this issue of GOOD LIGHTING. Moreover, Mr. Pembleton has the courage of his convictions, for we have materialistic evidence of his faith in such condition.

believer and advector of the reflection of individuality of lighting designificand since he has assumed the editorship of GOOD LIGHT-ING the cramms of this magazine have been freely used to assist in establishing such desirable condition.

Mr. Pembleton, writing as a member of one of the largest Profit: Utility Corporations in the country, emphasizes the importance of personality in business in a very interesting, convincing manner.

Central Stations and Gas Companies are appreciating to a greater extent the value of individuality in lighting design, and GOOD LIGHTING may be counted upon to lend them every assistance possible in eliminating the monotonous, unproductive, commonplace, and effecting personality in lighting.

LIGHTING OF SCHOOLROOMS

In this issue of GOOD LIGHTING, Mr. S. A. Thomas, Chief of Electrical Division, Board of Education, New York, contributes an article on the artificial lighting of schoolrooms, which important article is of a self-explanatory nature.

The Editor, who has been very much concerned in the lighting, both natural and artificial, of schoolrooms for a long time past, has conveyed some suggestions to Mr. Thomas, which, while having received publicity before, are reiterated here for what value they may be worth.

First, the subject of printing and types of books, etc., used by school children: The Editor is of the belief that a careful study would effect very great changes as regards typography, also whether symbols should be indicated as light mediums on dark backgrounds, or the reverse as is practised to-day. Also the introduction of non-glazed surfaces as in paper, etc., which would be found to better

suit the purpose. Further, if paper, of a tinted nature is better than "white" as is now generally employed.

Character and color of schoolrooms: Quite some attention has already been directed to this phase of the subject; but it is felt that arrangements and schemes of decoration now employed are susceptible to considerable improvement.

Windows: The Editor feels that changes can be effected in location, arrangement and character of windows through which daylight is permitted to enter rooms. There is a productive of combining daylight and artificial light controlled from the same general point, which scheme would seem to present possibilities.

Furniture: It is felt that the color and general areatment of desks used in schoolrooms should be scientifically established. Personally, the Editor feels that dark, matt finish, such at dark green, would be preferable to the mahogany and light oak finished to generally employed.

Blackboards: There does not seem to be any logical reason to the use of blackboards as now employed, especially when white chalk, giving rise to vivid contrast, is effected.

Rough experimentation tends to show that far better results are obtainable from a green glass, depolished slab, on which a light cream chalk is employed. The use of the latter mentioned method appears to be more agreeable to the physiological, psychological and aesthetic senses.

The subject of proper schoolroom lighting, both from the natural as well as artificial view-points, is important, not only on account of its effect on pupils while *in the school*, but also on account of its beneficial effect in tending to improve lighting conditions in the home in which the student usually studies.

It is proposed to conduct an educational campaign, both with school children and, through them, their families, to emphasize the importance of proper lighting, both in the home and schoolroom.

The effect of this educational work will undoubtedly assist materially in raising the standard of average lighting conditions.

ADVANCEMENT

As our knowledge and experience of things generally increase, we intuitively rebel against the commonplace, and, in most our every movement, endeavor to unshackle ourselves from conditions which, by their nature, breed depressing monotony.

Lighting operhaps the most diversified, extended subject coming under one heading—is now undergoing very decided changes in its creation and application, and not the least of such advancements is being conducted in its relation to those conditions which are agreeable to or finer selves.

Just a few, very few, years ago, it was no uncommon thing for men, then a eminently identified in lighting work, to, in effect, state that highting was a science, and the primary and all important phases of was consideration had to do with efficiencies and economies; but those and other persons affiliated with the movement have been efficiently wise to "see" the interpretations of a few advanced thinkers, with the result that there is a general recognition to-day for the subject of light in its great entirety, and there seems to be a willingness, in some quarters, to accord to the aesthetic somewhere near the true value of this important aspect.

Some persons heretofore not fully in sympathy with aesthetic considerations have, for commercial reasons, now recognized such as a great factor. Whether such recognition is sincere or insincere, or whether some persons now extolling the virtues of the aesthetic phase really know what they are talking of, is a matter of not great importance,—what we are concerned in is the fact that aestheticism in lighting is now coming into its own, and GOOD LIGHTING, the exponent of this and other—all—phases, may be relied upon to extend its continued support to such development.

MR. MILLAR'S ADMIRABLE PAPER

In this issue of Good Lighting is printed the paper presented November 18, 1912, by Preston S. Millar before the Joint Meeting of the New York Companies' Section of the National Electric Light Association and the Illuminating Engineering Society, at the New York Edison Auditorium, New York.

It is felt that a careful reading and digest of Mr. Millar's paper will permit of an understanding that needs no amplification in an extended editorial.

SOCIETIES

The Illuminating Engineering Society, with headquarters in the United Engineering Societies Building, 29 West Thirty-ninth Street, New York City, has Sections in the following cities: Boston, Philadelphia, Pittsburgh, Chicago and New York.

It is customary that in each of these Sections monthly meetings be held, at which time papers dealing with various phases of light are read and discussed. Each of the Sections endeavor to prepare a programme for the Season's activity.

Following is published the tentative programmes, to and including February, of the Chicago, New England, Pittsburgh, and New York Sections. These programmes will be amplified and extended from time to thee.

NEW YORK SECTION.

SECRETARY: Clarence L. Law, 124 West 42d Street, New York, N. Y.

January 9.
Joint meeting with the National Commercial Gas Association.

February 13.

Joint meeting with Municipal Art Society.

CHICAGO SECTION.

Secretary: J. B. Jackson, 28 N. Market Street, Chicago, Ill. January.

"Indirect Illumination as Applied to General Offices." By T. H. Aldrich, National X-Ray Reflector Co., Chicago, Ill.

February.

"The Influence of Colored Surroundings upon the Color of Useful Light," By M. Luckiesh, Physical Laboratory, National Electric Lamp Association, Cleveland, Ohio.

"Some Application of Illuminating Engineering to the Conservation of Eyesight." By F. A. Vaughn, Consulting

Engineer, of Dr. Nelson M. Black, Opthalmelesst, Milwaukee, Wis. "Gas Illuming 145.

Meeting at Mwanker in conjunction with the Milwaukee Electric Show

NEW ENGLAND STATEMONT

SECRETARY: H. C. Jones, 10 High Street, Boston, Mass.

"Vision and Defects of Vision."

"The Light of the Stars."

PITTSBURGH SECTION.

SECRETARY: C. J. Mundo, Oliver Building, Pittsburgh, Pa. January.

"Street Lighting." By C. E. Stephens. February.

"Gas Illumination."

Lectures on the elementary phase of the subject of lighting by Prof. H. S. Hower are planned for. The time consumed by these lectures will be approximately fifteen to twenty minutes, some to precede the regualr meeting.

German Illuminating Engineering Society Founded*

On November 2, 1912, the German Illuminating Engineering Society came into existence under the auspices of the Physikalisch-Technische Reichsanstalt in Berlin.

The importance of a recognized body representing all the interests of illumination has made itself felt in Germany for a long time. The lack of an authoritative

body capable of dealing with important questions connected with illumination, such as the establishment of standards, nomenclature, and units, methods of measurement, international agreements, &c., has often been painfully experienced. Above all, it is unthinkable that international agreement on such questions could be arrived at without there being such an

^{*} Translated by the Illuminating Engineer, London, from the official announcement in the Zeit-schrift filr Bekuchtungswesen, November 10, 1912.

acknowledged society. In consequence of its non-existence, Germany, which for a long time has taken an important part in connection with illumination, has gradually lagged behind, and in particular has been outstripped by the United States.

The interest in lighting taken by the gas industry has been exemplified in the Commission on Light Measurement instituted by the Deutsches Verein von Gas und Wasserfachmänner. The Verband Deutscher Elektrotechniker likewise attempted to standardize methods measurement for electric lighting, and framed rules for the phot metry of glow lamps and are lamps. I individual matters, especially as regard the standard of light, agreement between the various societies and institutions interested has been reachel; especially now that the Physikalisch T. conische Reichsanstalt, as the result 6, its classical investigation of the Hefner lamp and the comparison of it with earlier standards used elsewhere, has made the Hefner lamp a standard for light measurement for the whole world. Nevertheless, the mutual rivalry of the chief concerns interested in lighting and the constant competition between gas and electric lighting has materially hindered the co-operation between these parties, although, for the correct understanding of many important questions, and particularly the adjustment of international problems, such co-operation is most essential. This is much to the detriment of the whole science of illumination.

Many parties which are not represented in the institutions referred to above have, nevertheless, a keen interest in the development of illumination, but hitherto have not been able to make their views felt—e.g., those concerned with acetylene, petroleum and spirit lighting, the physicist, the chemist, the medical man, the sanitary engineer, the physiologist, the schoolmaster, and the factory inspector, &c. Formerly, if these specialists took any part in the discussions on questions connected with lighting, it might easily happen that their expression of opinion was regarded as "non-technical." Nevertheless, such "outsiders" are in a position to be of great assistance in deciding many important lighting questions. Moreover,

either on account of the nature of their special aims and objects, or on account of their being removed from the strife of commercial rivalry, these experts would often be able to originate scientific investigations and to solve problems which, while apparently far removed from commercial matters, are nevertheless of paramount importance as regards illumination.

To Kirchoff's genius and intuition we are indebted for a knowledge of the laws of radiation, which the investigations of Wien and Planck, of Lummer, Kurlbaum, Holborn, and Pringsheim, have established and enlarged during a decade. To-day this field is still far from exhausted, and these laws are already regarded as the basis of the development of illumination from purely empirical scientific data.

To the chemist Auer von Welsbach and the physicist Nernst we owe the first practical applications of such laws to modern illuminants.

To Prof. Hermann Cohn, the oculist, in conjunction with Prof. Leonhard Weber, the physicist, are due the investigations of the minimum illumination for streets, squares, schoolrooms, and private houses.

We have to thank Leonhard Weber, Lummer, Kurlbaum, Martens Ulbricht, and Krüss for apparatus which enables us to measure light with as much precision as is possible in other departments of physics. In the well-known workshops of Schmidt and Haensch and A. Krüss these investigators have found fellow-workers able to assimilate their ideas and develop them in a practical form.

The investigations of medical officers of health, school authorities, and factory inspectors have greatly aided the perfecting of our methods of lighting and their practical applications.

All these investigations have up till now stood more or less isolated, and their connection with practical illumination was very slight. Owing to the existing publications on these subjects being sharply divided into two sections ("practise" and "theory," so called), and because of the lack of an impartial platform for the free expression of opinion for representatives of divergent interests, difficulties have arisen which are quite unconnected with the

nature of the problems to be considered.

During the last year this has been made particularly evident owing to the movement originated in the United States and other foreign countries with a view to agreement on a common unit of light.

In order to remove these difficulties a request for the formation of an illuminating engineering society was made to the Reichsanstalt by the Verband Deutscher Elektrotechniker early this year, and strongly supported by the Deutsches Verein von Gas und Wassenfachmänner. This appeal received ready hearing, and the Ph.T.R. immediately formed a small committee to take in hand the preliminary steps for the foundation of a German Illuminating Engineering Society. Committee consisted of the following gentlemen: Prof. E. Warburg, The President of the Ph.T.R. Geheimer Hofrath Bunte, Herr G. Dettmar, Director Hagen of the Ph.T.R., Prof. E. Liebenthal of the Ph.T.R., and Prof. Brodhun of the Ph.T.R. By this Committee a number of prominent members of the lighting industry were called together, and the framing of the constitution of the Society was commenced. Unfortunately on account of the limited room in the Ph.T.R., the number of invitations issued was on a very moderate scale, and at the meeting many people and firms were of necessity absent whose support the German Illuminating Engineering Society could ill afford to lose.

On Saturday last the Society was established.

After the President's (Prof. E. Warburg) greeting to those present, there were short speeches from Geh. Hofrath Bunte and Herr G. Dettmar, who laid stress upon the weight and importance of the Society. The meeting chose Prof. Warburg as the chairman, Dr. E. Liebenthal as secretary, and Dr. Bunte and Herr Dettmar members of the Council.

The proposed rules for the Society were accepted with acclamation. We give the

following extracts:

"The aim of the institution is the furthering of the science of illumination both in theory and practice, and in particular:

(1) The concentration of the efforts of various circles interested in illu-

mination in Germany and other countries.

(2) The representation of German lighting industry in international relations.

"Members may be (1) individuals, (2) firms, corporations, and societies."

"The affairs of the Society will be conducted through:

(1) The officers, (2) the Council,

(3) members' meetings.

The Council in whose hands rests the carrying out of the practical work and special undertakings of the Institution is to consist of twenty-four members, of whom six must always be members of the Councils of the Verband Deutscher Elektrotechnischer and the Verein von Gas und Wassenfachmänner respectively, whilst the remaining twelve must belong to other bodies interested in illumination."

"Ordinary meetings of the Society are to take place from October to May."

"The annual meeting will, in general, take place in the autumn, outside Berlin. The Proceedings of the Society will be published in the Journal für Gasbeleuchtung und Wasserversorgung, the Elektrotechnische Zeitschrift, and the Zeitschrift für Beleuchtungswesen."

The first ordinary annual meeting will take place in Berlin in February, 1913. At this meeting the ordinary officers and Council will be elected. A general paper will be presented summarizing the science of illumination, and it is anticipated that this will be undertaken by Prof. Dr. Otto Lummer.

Until the first ordinary general meeting takes place Prof. E. Warburg (chairman), Dr. E. Liebenthal (secretary), and Geh. Hofrath Bunte, Herr G. Dettmar, Prof. Brodhun, and Director Hagen will provisionally take charge of the affairs of the Society.

The foundation of the German Illuminating Engineering Society is a milestone in the path of development of illuminating engineering in Germany. Through the influence of the Society, and by the friendly co-operation of the formerly conflicting interests which it will bring about, together with the special assistance of independent experts, the movement will no longer be confined to foreign countries.

PUBLICATIONS

Show Window Backgrounds

By George J. Cowan

In this 240 page book, price \$1.00, published by the Dry Goods Reporter, Chicago, an attempt is made to bring to the window trimmer, in book form, a collection of window background ideas.

Each of the some two hundred backgrounds have been executed by the author with the idea that each drawing shall serve the same purpose as the blue-print plans furnished by the ar nifect for the construction of buildings.

The drawings are clear and the versatile trimmer may easily adapt the ideas to

his peculiar regularements.

The first part of the book is laid out in chronogical order of an annual program of windows. First there are the New Year's Windows; then the January White Sales Windows; next Lincoln's Birthday, Valentine's Day, Washington's Birthday, St. Patrick's Day, Spring Opening, Easter, etc.

There are also included in this book about one hundred other background sketches, each one explaining some different style of decoration. The subject of window lighting is one of very great importance to the merchant, and is a most interesting and difficult problem for the lighting specialist to solve. Unfortunately, oft times, very little regard for the character and use of the window is taken into consideration when lighting installation for same is being designed, with the result that while we have effected certain improvements in window lighting, chiefly removing obnoxious glare, we have by no means developed, even to a small extent, the great possibilities of attractive window displays from the lighting standpoint.

If those having to do with lighting windows will familiarize themselves with the purposes for which windows have been created, also with the fascinating and important subject of window decoration, lighting effects produced will be greatly

improved.

The book referred to may help to more clearly establish this important subject.

Studies in Light Production

By R. A. Houstoun, M.A., D.Sc., Ph.D.

This 110 page book, price \$2.00, is published by D. Van Nostrand Company, New York.

The book, we are informed, was written with the purpose of collecting information about the efficiencies of our artificial illuminants as energy transformers, both for the sake of rendering the facts readily accessible and also for information as to the lines future progress is likely to take. From this standpoint photometry is not important, and, consequently, has not been considered.

The principal scientific journals have been worked through for the past twelve years, but the references to the literature given in the book are not complete, the less important papers being omitted. Ten of the twelve chapters have already appeared in "The Electrician" in a slightly different form, and the author acknowledges his indebtedness to Mr. W. R. Cooper, editor of The Electrician, for several valuable suggestions, also to Prof. A. Gray, F. R. S., LL. D., for the benefit of this gentleman's criticism.

The captions for the twelve chapters follow:

The Energy Spectrum; The Black Body; Flames; The Welsbach Mantle; The Carbon Glow Lamp; The Arc; The Nernst Lamp; Metal Filament Lamps; The Mercury Arc; The Light of the Future; On the Absolute Measurements of Light: A Proposal for an Ultimate Light Standard; On Apparatus and Experimental Methods.

GLARE

The defining of this too generally apparent, disturbing and destructive condition seems to be a difficult matter. However, after all, we are more concerned in its elimination than in its definition.

Glare, resulting from the use of glazed (calendered) papers, and glossy inks is much too prevalent—of this there is no doubt.

Observe the character of the paper and ink used in GOOD LIGHTING—and the lack of glare. The effect is much more comfortable to the eye, besides being pleasing to the aesthetic sense.

The Editor of GOOD LIGHTING has been experimenting for some time past in the effort to effect appreciable changes in typography, the results of which study will shortly find at least partial expression in this magazine.

Furthermore, it is planned to show, in an early issue, another development which is felt will tend to revolutionize a certain feature of the printing art, all of which advancement is in keeping with the broad policy now actuating the publication of GOOD LIGHTING.

RATIOCINATION

A big word with a big meaning.

Reason, the process of analyzation and syntheticism, usually culminating in a wiser and broader understanding, makes for advancement.

The exercisement of reason has indicated the importance and justice of according to light more nearly the extended and deep consideration due this important subject.

The great advances we are now witnessing in the development and application of light are chiefly of the nature of refinement, assuring pleasure and comfort, as well as profit.

The crude is refined with reason.

More life to reason!

Albert Jackson Marshall Editor



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McALPIN HOTEL, NEW YORK F. M. ANDREWS & CO., ARCHITECTS.

LICHTING OF THE MOALL HOTEL

We thought that the construction of this issue of Good and the pressure of the pressure of the McAlpul Hard would be pred rive of desirable results. We were wrong the gentlement we counted the pred rive of the article some time since unto the first the preventing the article addition to his fame, and incidentally holding up the publication of this issue of Good and the editor writing the article.

All of which is introductory to an riccle on the lighting of the Hotel Mc-Alpia hastily prepared for the emergency, which probably will not do the subject full justice, but is, nevertheless, an attempt to carry out a promise, and should thus be appraised.

At the beginning we wish to have it known that we are indebted for much valuable assistance to the architects of the hotel—F. M. Andrews & Company—also the management of the Hotel Mc-Alpin, who very graciously supplied most of the photographs used in illustrating this article.

Had time permitted, the article would have been further augmented by architects' and engineers' plans and elevations, the use of which Mr. Schloss, the engineer associated with F. M. Andrews & Company, kindly offered, but which, unfortunately, would not become available until such time as to further delay the publication of this issue.

The Hotel McAlpin, which opened about the middle of December last, presents to the public of New York and the country at large a new and interesting type of hotel, inasmuch as it was financed,

planned and built with the idea in mind of providing first-class accommodations at moderate prices.

The idea involved in the Hotel Mc-Alpin was originated by F. M. Andrews, who interested capital and brought about the organization of the Greeley Square Hotel Company, of which he was presdent until the practical completion of the building and the acquisition of a lease on property owned by the McAlpin Estate.

The hotel company, in co-operation with the trustees of the McAlpin Estate, have carried the idea to completion, with the result that what is claimed to be the largest hotel in the world has now become one of the active features of New York life.

The Greeley Square Hotel Company is both an owning and operating company and has received, we are told, its principal financial support from such stockholders in the enterprise as Charles P. Taft, of Cincinnati, Ohio; General T. Coleman du Pont, of Wilmington, Del.; Samuel Mather, of Cleveland, Ohio, and many other men similarly important in the business world.

It might be of further general interest to know the present officers and directors, who are as follows: C. H. Rembold, Cincinnati, Ohio, president; T. C. du Pont, Wilmington, Del., vice-president; B. B. McAlpin, New York City, treasurer; Wm. A. Ulman, New York City, general counsel; Charles P. Taft, Cincinnati, Ohio; L. M. Boomer, New York City; F. M. Andrews, New York City; L. L. Dunham, Wilmington, Del.; C. A. B. Pratt, New York City.

The all important question of the operating management of the property re-

ceived the careful consideration of the Board of Directors for over a year, and the respective qualifications of many of the best-known hotel men of the country were reviewed and passed upor white result that the work of operating the hotel has been entrusted to Messrs. Morry and Boomer, whose records as successful and energetic men are of such a character as to qualify them for their important work.

F. M. Andrews & Company, of New York City, were the architects of the building, and the planning and designing was carried on under the direct personal charge of F. M. Andrews.

The building was constructed by the Thompson-Starrett Company, of New York City.

To the establishment of John Wanamaker was entrusted the furnishing and equipping of the hotel, which in this instance, we are informed, constituted the largest and most difficult order of its kind ever placed in the history of hotel construction.

It is due to the united efforts of these organizations and individuals that this great hotel has been brought to completion practically on schedule time without serious hindrance or delay.

The location of the hotel with reference to the lines of transportation is enviable, giving ease of accessibility, which is of prime importance to the traveling public, while its situation in the heart of the shopping and theater district gives it environments so essential to the success of a great hotel enterprise.

The Hotel McAlpin stands at the intersection of the Sixth Avenue, Broadway and Thirty-fourth Street surface lines; the Sixth Avenue Elevated Railroad; the underground transportation system, consisting of the McAdoo Tunnel (serving New York as far south as the Hudson Terminal Buildings and New Jersey points), and the Subway, a few blocks distant; also the Pennsylvania and Grand Central stations, which are in close proximity; all of which constitute a network of lines of communication reaching practically to every point of the world.

The planning and arrangement of this great structure, at rates from \$1.50 per

day a room to \$5 per day, is of peopliar significance to the traveling public, while furnishing an example of what may be accomplished along these lines despise the adverse conditions of expensive construction, real estate, and the prevailing high cost of living.

The principal hotel entrances are upon Thirty-fourth and Thirty-third streets.

floor arrangements below street hevel consist of four basements, the first one below grade being devoted to a public to by, with direct corridor communication to the subways, barber shop, toilet room etc., kitchen and service rooms rereiving room, helps' entrance, and to what stated to by the largest rathskeller in the city

The renaining basements are devoted to mechanis equipment, wine steward, and steward department, laurdry, and other work departments of the establishment.

The second story, covering lot area, is arranged with a gallery overlooking the lobby below, the main restaurant, banquet room, ladies' restaurant, ladies' reception room, men's writing room, service kitchen, and other incidental features.

Immediately above this floor is the mezzanine, which is devoted to private dining rooms, and a general club room for men.

The bedroom floors, beginning at the third, are arranged with two open light courts facing Broadway, so that all rooms have access to outside light and air.

The bedroom floors extend to the twenty-fourth floor, and the twenty-fifth story is devoted to the housing of the operating force resident in the building.

The twenty-sixth floor contains the large ballroom and convention hall, Turkish bath, with private roof garden, and a general roof garden; also kitchen for independent service for these features.

The exterior of the building is an interesting example of the application in feeling of detail of the spirit of the Italian Renaissance to the modern type of tall building construction, and is characterized throughout by a well regulated use of colors and texture in the materials employed.

The base of the building is constructed

ENTRANCE TO CENTRAL LOBBY FROM THIRTY-FOURTH STREET.

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of Bedford stone, which supports the shaft of the design, constructed of golden brown tapestry brick, the mass of which is relieved by balconies of terra cotta or of iron, imparting to the structure the semi-residential character which differentiates, the hotel from a purely commercial building. The crowning member of the design consists of a series of arched openings running through several stories in height, supporting a cornice and attic story, the whole being enriched with polychorae terra cotta.

In describing the interior arrangements of the hotel, it is interesting to note one feature which largely influences the plan and arrangement of the first and second stories, an arrangement which marks a definite departure from the established New York type of hostelry. This feature consists in the utilization of the valuable retail store renting space facing three streets, and the location of the dining room and restaurant service of the house one story above street level, all of which has been accomplished while still retaining sufficient space on the ground floor to provide the hotel with probably the largest lobby in the city. This arrangement gives a very attractive outlook and street prospective from all cafe windows, while at the same time placing them above the dust and confusion of the sidewalk.

Entering from Thirty-fourth Street, under a very attractive permanent canopy extending over sidewalk to street, which is outlined underneath in cylindrically formed opal glass globes, providing at once suitable illumination and pleasing effect, one encounters a broad, one-storied corridor, the lighting of which is provided for by eight upright, two-armed brackets, supporting clear glass globes of flamboyant design, housing tungsten lamps. From the centers of each of the four rectangularly formed ceiling recesses are dropped lighting fixtures in lantern formation, the bottoms and sides of which are equipped with flat white glass of the opal type. The general effect produced by these illuminants is, on the whole, satisfactory. However, even better results could be obtained if the flamboyants located on pillasters were equipped with a diffusing, instead of clear glassware, and, further, if the light-sources in the lanterns suspended from ceiling were so placed and equipped as to eliminate the "spots" of lights now indicating location of illuminants contained in same.

The effect of more nearly perfect diffusion, in the center fixtures, could be obtained by using heavier or more thoroughly diffusing glassware, but it is felt that similar results could be more economically obtained by the use of a single illuminant placed with due reference to the present diffusing surfaces.

The corridor—just treated—leads to a specious, one-storied isle surrounding the central lobby, that rises three stories in height above the pavement. This lobby is designed in severe and simple Italian Renaissance, executed in marble and Caen stone, and consists of a series of arched openings supporting a vaulted ceiling. The arched openings are decorated with Preche violet marble columns supporting a cornice and balustrade at the second story level, where openings give a general view of the lobby below from the tapestry gallery. The remaining space within the arched openings form lunettes which are beautifully decorated by mural paintings by T. Gilbert White. These paintings, eight in number, represent jewels, and are typified by female figures, the draperies and accessories in each instance taking up the color of the jewel portrayed, the result being a notable contribution to the mural art of New York City.

The lighting of the central lobby is chiefly dependent upon three unique chandeliers suspended from the ceiling, which are executed in carved wood, colored deep red and dull gold, the bottom of which is a bowl of alabaster through which the rays of tungsten lamps, hidden from view, are transmitted.

As will be noticed from photograph of central lobby, these chandeliers support two circles of 40-watt all frosted tungsten lamps. Supplementing these three main fixtures are eight bronze side brackets supporting five upright arms in candle formation, which are surmounted by all frosted, round bulb, tungsten lamps. The lighting of this lobby is further served by four standards, two being placed amid group of palms at either end of the

CENTRAL LOBBY.

Copyright, Byron, N. Y.

lobby. Here are also employed five candles supporting round bulb, all frosted, 25-watt tungsten lamps.

Inasmuch as the general effect of the lobby is one of rather unusual lightness, due to the character of materials and decorations, the illumination values is capping-spondingly high. The desire are for the cation of the lighting fit good. Frowever, most part unique and there is at least one feature in connection there is at least one feature in connection with the three main children will be open to criticism.

As previously indicated, and otographs noticed in the accompanying to the bottoms of these fixtures are piece of alabaster which, when uluminated from within, challenges one's mechanical as well as æsthetic sense, for while the fixture is really in suspension, yet the effect is that of rest on a void, while the contour of the fixture is also interrupted. However, the fixture can lay claim to a certain degree of originality, and for this we should be duly grateful.

The ceilings of the surrounding corridors, both on the first floor and the tapestry gallery, on the second, form a part of the general picture presented to the observers from the ground floor, these ceilings being decorated in a general groundwork of dull gold, relieved by touches of dull blue and red in the background of the ornament, forming a rich contrast to the general light gray effect of the central lobby.

The lighting of these spaces is principally by small editions of the three chan-

deliers used in the central lobby.

To the immediate left of the Thirty-fourth Street entrance is the ladies' reception room, which is illustrated in a photograph accompanying this article. This lighting of this room is provided for by a central crystal chandelier suspended from the ceiling; side bracket crystal chandeliers, each supporting in an upright plane three candles with frosted "flame" lamps, and a portable lamp placed on table below ceiling fixture. Tungsten lamps are used in lighting this room.

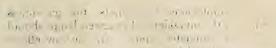
Inasmuch as this room is for the use of the ladies, and as the ladies are partial, and rightly so, to lighting that enhances, or we might even dare say improves, their complexions and toilers, the garishness of the using datated tungson tamps should be eliminated, and "soft," mellost effects produced to its stead.

In the center chandelier this change could be accomplished by either "burning the rungsten lamps under voltage, or treating to lamp bulbs with delicate translucent color-transforming solutions or elimination the rungsten lamps and substitutions of the cobon type, which are richer in the reds and yellows, being far less "cold" and harsh.

As rega de tue side brackets: A common faut Aheres candle lamps are employed, is the use of "white" illuminants, which is contrary to the color effect produced from the candle flame. Where candle "flame" lamps are employed, and especially so when unaccompanied by surrounding mediums, such as, for instance, silk shades, they should almost invariably be operated below voltage; that is to say, if the voltage is 100, the lamp voltage should be, approximately, 120 to 130, which will insure more nearly correct representation of the color value of candle flame than is effected by pr practise.

It is to be understood that any criticisms made relative to the lighting of the Hotel McAlpin are intended to be of a purely constructive order, and not confined solely to the installation in question, but likewise to conditions generally observed. It heretofore has usually been the policy of manufacturers of lighting equipment to have some one in their employ write an article which, while presenting the installation, emphasized its value and accomplishments with a corresponding lack of constructive criticisms to its shortcomings, all of which, while helping to a degree the furtherance of lighting knowledge, has not been as effective in preventing future errors, as is desired. policy of GOOD LIGHTING is to give praise where praise is due and to point out where and how improvements can be effected.

Westward along the northern corridor of the central lobby there is direct communication with the men's bar and cafe. This room, housing one of the most beautiful bars to be found in New York, is designed after the manner of the fifteenth





century Italian Gothic, with paneled wainscot from floor to ceiling of French walnut. The ceiling is vaulted with low springing arches and left severely plain in treatment. The wainscot is divided off in square and diamond shape panels, and its cornice, entirely around the room, has its frieze of carved wood touched up in gold, giving an antique effect, while at intervals along the frieze there appear shields upon which are various coats of arms representing the royal Italian families from the Roman period to the modern time. The columns have been so constructed as to contain niches in which figures carved in wood and decorated in polychrome color reflect the fifteenth and sixteenth century decorative works of Italy. The execution of these arched figures is singularly interesting and has been inspired by Gustav Doré's illustrations of the stories of Balzac. At the southern end of the apartment is located the bar, which projects into the room with a semi-circular sweep, while at the northern end is situated a cigar stand. The central space of the apartment is provided with chairs and tables and a specially woven rug in harmonious coloring with the room.

The lighting of the men's bar and cafe is chiefly provided for by a number of fixtures suspended from ceiling, as indi-

cated in photograph.

The lighting features of this fixture consist of six uprights in candle formation, supporting all frosted tungsten lamps, which are partially surrounded by silk lamp shades. The ring on which these six uprights are mounted supports at its base a disc of rippled glass, back of which are placed six tungsten lamps. Due to the character of this fixture, and the light ceiling, the illumination effects might be characterized as direct and semi-direct.

As is the case with some other lighting fixtures used in the Hotel McAlpin, these fixtures are unique.

As is so ofttimes the case when dealing with semi-indirect, or what might be termed transmitting glass mediums, rather poor diffusion is obtained through the glass due to the improper placing of light-sources placed therein or behind. In the fixtures in question, six distinct spots of

light are to be seen through or on the glass disc on bottom of fixture, which materially detracts from the fixture's general effectiveness. It is probably necessary in this fixture to employ several small lamps instead of one large unit, and it is felt that if necessary a higher absorption of light would be warranted, using a better glass diffusing disc than that now employed.

It seems strange that with the great strides that have been made in the use of light, and the confragative ease in which well-nigh perfect diffusion is obtainable, that so much lighting glassware used in fixtures, or the illuminants used in connection therewith, is employed in a manner to destroy rather than to add to the beauty as well as general effectiveness of the fixture. If less attention were paid to the matter of absorption, and more to general results, conditions would be improved.

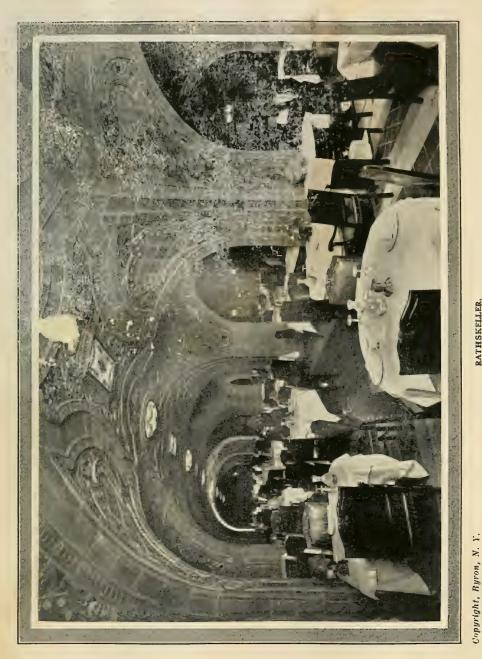
It is a well-known fact, not only in the matter of lighting, but all other conditions associated with our existence, must recognize a certain loss in crude to effect refinement, and if we are not satisfied to thus get refinement, we should confine our efforts to the development of accessories which do not require such refinement in their development.

Lighting is an art as well as a science and is susceptible to the most wonderfully satisfying creations, provided care and thought are exercised in its development. It is, however, something that will suffer through lack of well organized thought.

Unusually liberal provision has been made for public telephone service at the southeast corner of the central lobby, adjacent to a broad marble staircase leading from the lobby to the second floor and to the first basement, below which a wide and emple corridor connects with the Subway entrance and to the rathskeller, as well as to the elevator hall.

The rathskeller will be of exceptional interest to the public because of its color scheme and design. In floor area it is said to be approximately double the size of any similar room in New York City and is designed with a series of columns supporting low-groined vaulting, the whole being constructed of polychrome





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terra cotta decorated in the feeling of the Spanish Renaissance, while a brilliant color scheme, as utilized in a new method of blending colors by running the glazes on the terra cotta, and the skillful handling of the juxtaposition of color, results in a charming and novel effect parte new to the use of this material.

The lighting of this room is from recessed spaces in the valled surfaces, which are covered with painted porcelain, matching the color scheme of the room combined with the illuminating effects produced from table lamps used throughout, and brackets around the sides of the room. It is stated that the purpose has been to obtain an atmosphere of coziness and quiet charm in this room as apart from the usual effect of display aimed at in rooms of this character. Undoubtedly the desire has been largely realized. It is well within the powers to effect such result almost in an entirety.

As indicated, the general illumination of the rathskeller, especially in the center portions of the room, is practically dependent upon lamps recessed in the ceiling and covered with a white porcelain glass bowl, which has been decorated to match the polychrome color scheme of the terra cotta. The effect produced from these illuminants is wonderfully pleasing and quite different from most anything that has been heretofore offered in places of such character. The quality of the light emitted from these ceiling bowls is of a rather rich, warm nature—a very pleasing change from the now too prevalent method of overlighting interiors of a similar nature with garish "cold" illuminants.

The general illumination provided by the ceiling bowls is hardly sufficient for reading and eating purpose, and is, therefore, supplemented by table lamps consisting of a stand and silk shade covering tungsten clear bulb lamp. Inasmuch as the lamp in question is of what might be termed a "white" order, the rays which are reflected from the white table cloth cause the table and faces of the diners to stand out in quite sharp contrast with the beautiful low, soft general illumination. While it is realized that the purpose of the table lamps is to provide a higher local

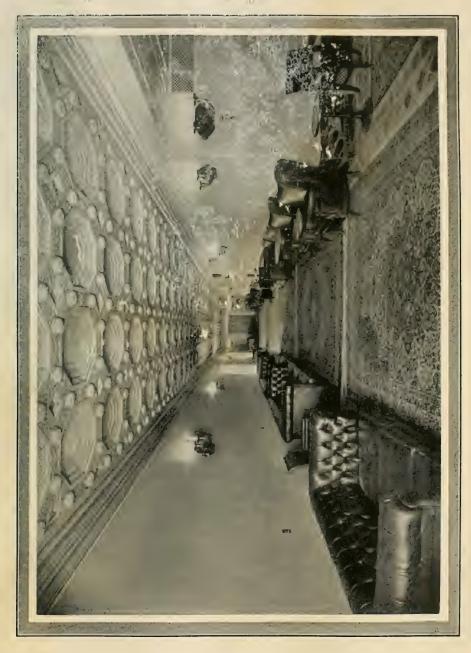
illumination than that obtained by general illumination, yet it is felt that if here again the color of tungsten lamps were modified by some translucent solution or diffusing medium, so that its garishness would be eliminated, that much more pleasing results would be obtained, not only both to the occupants of the tables, but considering the room in the ensemble.

Around the sides of this room, as stated, are located brackets with upright arms supporting tungsten lamps, which are entirely out of order. These side brackets injure materially what is otherwise a very acceptable scheme. They are in direct variance with the cozy, quiet charm sought for in the rathskeller, and should be entirely done away with, and especially so as no part of the room is dependent upon them for illuminating value.

On the second floor, one of the principal points of interest is the tapestry gallery, so called because of its wall decoration of Herter tapestry, especially woven for this apartment. This broad and spacious gallery extends entirely around the central lobby, which it overlooks. The tapestry gallery is especially created for the use of guests of the house and is separated from the traffic and turmoil of the main floor.

The Herter tapestries are worthy of particular attention because of their high artistic merit and because of the local interest attaching to them because of their having been executed in the United States by the Herter looms, being the most important order of the kind executed in this country. The theme chosen for treatment of design is the military history of New York, beginning with the days of the early settlers down to the period of the Civil War. These tapestries have been exhibited at art exhibits in the principal cities of the United States and have attracted wide interest and comment.

The men's writing and lounging room, located on the second floor, and herewith illustrated, is lighted by side brackets, each carrying two upright arms in candle formation supporting round bulb, all frosted, tungsten lamps. Inasmuch as the walls and ceiling of this space are light in color, a relatively high reflection of light from the illuminants is obtained, thus providing



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adequate illumination for those who might care to read while enjoying the comfort of the luxuriously upholstered chairs and lounges. The chief condition to be avoided while seated in one of the chairs or on one of the lounges, is that of having one's eyes encounter the brilliant, though frosted, bulbs, which might well prevent the full ease and relaxation that the otherwise comfortable appointments insure.

The main dining room is off the apestry gallery and runs along the entire Thirty-fourth Street frontage of the building. This room is decorated in Louis Seize period in light natural oak, all ornament gilded, with side walls hung with old gold silk damask. The windows are draped with similar gold damask with embroidered valances, with filet laces at

the windows.

The treatment of the columns and pilasters of this room with mirrors produces one of the most unique effects ever accomplished in this country in a room of this character.

The decorations of the ceiling are in monotones of cream and gold, which not only diffuse the light striking same, but lend to the room an imposing effect of

height, breadth and length.

The lighting effect of the main dining room is accomplished by crystal chandeliers which in part support candle formations; bronze and crystal side brackets harmonizing with chandeliers; also portable table lamps.

Modification of color of artificial illuminants could be well effected in this room. Multiplicity of reflections due to mirrors further emphasizes the need of

such change.

Otherwise the lighting system is in har-

mony with the interior.

Directly to the west of the tapestry gallery, along the Broadway front, is the banquet room, with groined vaulted ceiling carried out in the French style adapted from the Italian. The walls are in green and gold, divided into panels by pilasters and cornice, the panels being draped with green damask reproduced from antique fabric by special order. The lunette panels on the side walls produced by the crossed vaulting of the ceiling are decorated with beautiful paintings in antique tones harmonizing with the room.

The lighting of the room is administered to by three massive, beautiful crystal chandeliers, in which all frosted lamps, both of the standard bulb shape and round bulb type, the latter used in connection with candle formation, are employed, such principal lighting being supplemented by a number of brackets located between the pilasters about the sides and ends of room. These side brackets are in metal and crystal, and each support a group of four upright candle-like stems, surmounted by tungsten lamps, the bulb of which is all frosted and shaped as a flame.

The lighting as a whole in this room is generally satisfactory, although here again improvements may readily be effected if the obnoxious garishness of the unmodified tungsten lamp were eliminated by introducing some of the warmth of our old stand by—the common garden variety of

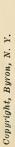
the candle.

Auminaring efficiency in lumens-perwatt, as "termined purely by photometric means terior of this character, losery terior of this character, losery terior of this character, losery te effectiveness of the lighting as deliberated logical, sociological and aesthetic senses. Such being the case, the "hard," glaring, "cold" light of the untreated tungsten lamps should either be relegated to the rear, or suitably treated for the work at hand.

With reference to the bed room floors: It may be stated that the variety offered in size, price, decoration and furnishings is unusually large. The appointments of the bed rooms, both in furniture, carpet, draperies, linen and minor detail, are of the very best quality, and the most exacting care has been exercised in arranging these appointments to suit the character and size of the particular room involved.

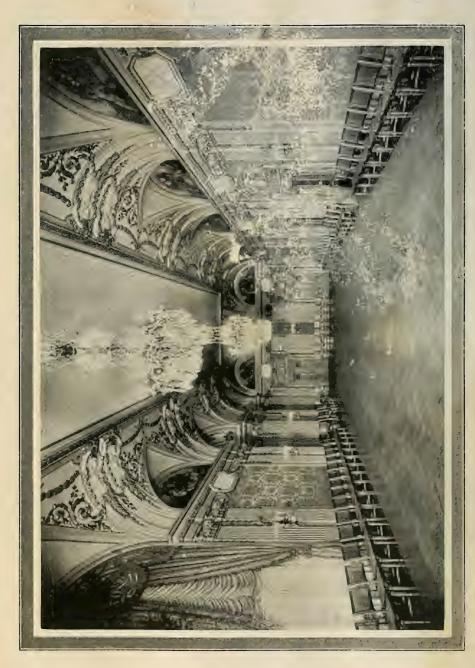
Each bed room floor has its ample service kitchen and floor clerk in charge, thus facilitating prompt and effective service.

Another unusual feature to be found in the hotel is that the twenty-second floor is devoted exclusively to men, this floor being fitted up with club rooms, richly decorated, assigned for the use of the Army and Navy of the United States, while the fourth floor is devoted exclu-





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LADIES' RECEPTION ROOM.



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sively to women with a view of extending every convenience and comfort to those who are visiting for day's shopping in the city, or who find it necessary to remain over night.

Arrangements are being made to obviate the necessity of unattended women going to the clerk's desk to register. It is understood that a special attendant will be at Milady's command at the Thirty-fourth Street entrance to guide her to her floor.

The illustration depicting typical bed room of a class shows the use of what might be characterized as a semi-indirect lighting fixture consisting of opal type of glassware, in the shape of bowl, suspended by three chains from ceiling. This arrangement of lighting equipment, which is rapidly establishing itself, provides an exceedingly pleasing general lighting effect to the room, and considered in its entirety represents one of the most satisfying results obtained in the lighting of the Hotel McAlpin.

The architects have had the foresight to provide side brackets either side of the dresser, which enables the guest to see both sides of his face simultaneously. These side bracket fixtures, which are of the pendant order, are equipped with glassware of the opal type, similar to that used in ceiling fixture, thus preventing the blinding glare of the bare lamp from entering the eye. Each of these side brackets is provided with pull-chain switches.

There is probably no feature of the lighting of a hotel that is generally more important to the guest than that provided for dressing or shaving purposes. The average guest established in a transient

hotel is in his room but a comparatively few hours out of the twenty-four. Aside from sleeping the room is most required for dressing and most of us, during such operation, call into service a mirror. Even though he be a contortionist, the average person would have difficulty in appraising his physiognomy or discover the location of the few remaining hairs adorning his crown, with the aid (?) of the averagely located fixture in the vicinity of the dresser or chiffonier. Therefore, the guests of the McAlpin will undoubtedly appreciate the thoughtfulness of the architects in providing suitable lighting arrangements which will enable them to properly groom themselves without making excessive demands on their agility.

There are several other interesting features connected with the lighting of the Hotel McAlpin which, if time permitted, we would incorporate in this article. Such being an impossibility, we hope to be able to treat further with the lighting of the Hotel McAlpin in some future issue of Good Lighting.

The rooms referred to in the second story, and men's café and bar, an all of the decorative features, modeling furnishing, hangings, draperies, mural paintings, etc., were executed by the firm of L. Alavoine & Company, decorators, of New York and Paris.

The lighting fixtures throughout the building were designed and manufactured by Bagues Freres Company, of Paris and New York. The equipment for the important public rooms was manufactured in Paris, and the fixtures for all bed rooms, in the United States.

·PRINCIPLE·OF·THE·SHADOW·

It is claimed by R. G. Waddy in Archives of Ophthalmology that the principle upon which the explanation of the movement and locality of the shadows of skiascopy is based is that of regarding the emergent rays from the observed eye as all important. The great majority of authors lay too much stress upon the incident rays—that is, upon the course followed by the individual rays from the source of illumination to the mirror, and

thence to the patient's retina, laboring meanwhile over the incidental refractive error. This latter is of negligible importance to the incident rays and can be dismissed in a word. Its sole function is to convert the theoretic "point" of illummination upon the retina into an area, or region, by virtue of the diffusion circles created, and, as he shows us, this is a factor of neither inconvenience nor instability in his explanation.

A MODERN GAS LIGHTING INSTALLATION BY THOMAS SCOTILLED

A modern, gas-lighted display room equipped with the most up-to-date lighting installation and containing on view the most advanced types and styles of gas burning appliances for domestic uses, sums up, in a few words, what the Consolidated Gas Company of New York maintains at 112 West Forty-second Street, nearly midway between Broadway and Sixth Avenue. This store not only is used as a display room, but also contains a branch office of the company, so that the public has a well appointed and commodious office in which not only to view the appliances on display, but to transact such business as opening new accounts, paying bills, renting or buying appliances, etc. The location, on one of the main arteries

of the vast retail district, or what may now be called the heart of the shopping district, called for an office and show room befitting the location, and this has been adequately taken care of, for this display room and office, devoted solely to the transaction of gas business, is one of the largest and handsomest in the world.

Extending through from Forty-second Street, where it has a frontage of fifty feet, to Forty-first Street, where the frontage is seventy-five feet, it comprises a total floor area of about 11,000 square feet, and has a ceiling height of fourteen feet six inches. Of this floor space the Forty-second Street end, or front of this office, is used as the display room, and the



LOWER EXTERIOR OF BUILDING HIGH PRESSURE GAS LAMPS.

remaining area is occupied by the branch office, with its clerice' force.

The office is finished handscreely in oak, with the walls and columns done in a light cream color and with the ceiling in white. To the right, on entering from Forty-second Street, is a large compartment in which is located a domestic kitchen, with all the latest designs of gas appliances for the household use on dis-

simplest lamp to the most elaborate lighting standard of housy bronze and decorative glass.

The lighting of this immense office and display room offers a striking example of what may be accomplished with gas in a modern lighting installation, embracing beauty, comfort, convenience and efficiency. Two systems may be said to have been used, namely the semi-indirect and



GENERAL VIEW OF GROUND FLOOR.

play. Adjoining this compartment is a similar room, but this offers a hotel kitchen, with four-section hotel range and with many of the accessories, both labor and time saving devices, in such common use at the present time. For the convenience and comfort of its patrons a room has been set aside, next to the hotel kitchen, as a rest room. Here, with soft rugs underfoot, oak-paneled walls surrounding and comfortable chairs and lounges provided, the ladies may rest after their busy shopping trip, or may read the literature of the day or write a necessary note in comfort and quiet. The fourth and last room, or alcove, is devoted to the display of lamps and glassware, from the

the direct. In the former there are thirtyone semi-indirect fixtures used, both the fixtures themselves and the glassware having been especially designed for this installation. These fixtures are located in three longitudinal lines from front to back of the office, and are spaced fifteen feet apart on each line, the two longest lines containing thirteen fixtures each, and the shortest line containing five fixtures. The lines themselves are spaced twenty-four feet apart, the two outside lines in every case being twelve feet from the wall, and the fixtures extend four feet from the ceiling to the bottom of the bowl. As can be seen from the photograph, this fixture is of bronze, with a simple and yet effective and pleasing . an intation, and supports an elliptical plabaster bown twelve inches in diameter at its neck. Inside this bowl are located three single mantle inverted gas lamps which completely fill the howl with a soft white light.

The lighting and extinguishing of these fixtures is accomplished by means of a small ignition filament attached to each individual lamp, and a single magnet valve for each fixture. These th ee filaments and magnet valve are worked simultaneously, in each fixture, by the pressure of a button located on one of the columns, the lamps immediately lighting, and are extinguished by the pressure of another button, located on the same column, these buttons being respectively white and Ilack, according to the usual practise. These controlling buttons are grouped in sets of six in small panel boxes located on the columns, the grouping and location being absolutely optional and, of course, in no way affecting the operation of this system.

This describes one method of control, but in this section controls have been

provid

The method of lighting and extinguishing or, rather, method of control since the filaments and valves are used, is a purely automatic one, all of the thirtyone fixtures being controlled by a master switch operating both ways; that is, for both lighting and extinguishing. On closing this switch, all of these thirty-one units may be lighted or extinguished in a period of elapsed time of one minute and thirty seconds, without any further effort than that entailed in the actual throwing of this small switch. It is also possible, having predetermined to light, we will say, every other one of these fixtures, by the simple shifting of a few small plugs in the panel board, where the master switch is located, to have this mechanism accomplish this lighting, again, the only manual effort required being that of throwing the said switch. This also holds true for the automatic lighting or extinguishing of any possible combination of these fixtures, so that the system is absolutely flexible and can be made to meet any conditions found necessary.

So much for the "mi-indirect lighting inst dation. Augmenting these lighting units, both im regard to effective illumination and effective artistic decoration, we have the direct lighting system. This installation comprises sixteen column fixtures of bronze, which completely encircle each column at a height of nine feet from the floor. As the semi-indirect, these column fixtures were especially designed



CEILING FIXTURE.

for this installation and carry out the same simple yet rich decorative scheme as shown in the others. Each of these fixtures is equipped with twelve single mantle inverted lamps with alabaster ball shades, the lamp being so set in the bronze ring that this shade is the only portion which is visible. In size these units are very small, having a consumption of only about 1.5 cubic feet per hour, as compared with the lamps used in the semi-indirect installation, whose consumption is about 3.5 cubic feet per hour. Small as these lighting units are, each lamp is equipped with a filament ignition, but with only one magnet cock to control each fixture. These filaments and the magnet cock are

operated from a single push button, as in the previously described system, but in this case this switch is a pendant one, so that each fixture is operated from its column. Of course this is merely a matter of choice of place of operation, since these buttons could have been placed any point in the office.

The motive force or actuating power for this entire system of ignition, that is for both the semi-indirect fixtures and for the column fixtures, is located in the basement of the building and consists of a

Local lighting, in a sense, is also shown in this office in the two kitchens and in the ladies' rest room. This, of course, in each case is typical of the correct methods of lighting such interiors, and in the ladies' room it is primarily used for decorative purpose. For this last purpose also the oak solumn at the end of each of the booth partitions is surmounted by a bronze and alabaser glass lighting unit, which serves to the a final decorative touch to these exhibition rooms.

Not alone is the interior of this office



DEMONSTRATION KITCHEN.

storage battery, 100 ampere cell, and a small motor generator set. The system is operated from the storage battery, which is charged by the motor generator set, or it can be operated directly from the motor generator. While this apparatus, when described, might lead one to the supposition that it was somewhat bulky and cumbersome, as a matter of fact the space occupied by both storage battery and motor generator set is about six feet long by three feet wide, which includes the wire mesh cage surrounding this apparatus.

lighted by modern methods, but the office front has been similarly treated as shown in the illustration.

The photograph of the Forty-second Street office front shows an installation of high pressure gas arcs, each of these six lamps being of 1500 candle-power, the resultant illumination making this spot undoubtedly the brightest on this thoroughfare. These lamps are likewise controlled automatically, the mere starting of the small gas booster in the basement being sufficient to cause the lighting of every one of these lamps.



RECEPTION ROOM.

point of interest in connection with installation he act that it was while the lice was in full operation, where over one hundred clerks, who had been using individual desk lights, were continually at their desks and where the public was always entering and leaving the display room, and this without the slightest discomfort or inconvenience to any one concerned. Also of interest, purely on the side of economy, is the total gas consumption, exclusive of lamps on exhibition, which is approximately seven hundred cubic feet per hour, a remarkable figure when considered in the light of the character of this installation, where the perfect diffusion of the soft white light

from these units makes a startling impression at night on the passer-by. In this connection a rather curious and interesting, though accidental, effect may be obtained by one looking through this office at night toward Forty-first Street. Directly opposite the Forty-first Street entrance is the rear of one of New York's numerous theaters, and on this building are hung a number of flaming arcs. The observer's eye is immediately made to realize the daylight qualities of the office lighting, as these arcs, directly in his line of vision, with their pinkish yellow light, make a marked contrast in point of color with this office lighting, and a contrast which cannot readily be missed.

Hunting Badgers with a Searchlight

In some parts of Portugal a queer method is pursued in regard to the hunting of badgers and foxes. Badger hounds are used—short-legged animals that can crawl into the burrows of their quarry. Each dog is provided with a collar on which is mounted, like a tiny searchlight, a little electric light operated from a small battery which can be carried about by the hunter.

When the dog enters the hole the light is turned on, and the glare frightens the hunted animal out at some other hole, where he is bagged.

From Father Neptune's White Light District

Some of the luminous fishes inhabiting the sunless depths of the ocean which have been drawn up from their haunts a mile and more below the surface by deep-sea exploring vessels. Models of these are on exhibition at the New York Museum of Natural History.



THIS DENIZEN OF THE PACIFIC CARRIES A LUMINOUS LURE AT THE END OF A FISHING-ROD, TO ATTRACT ITS PREY.



A MONSTER OF THE ARABIAN SEA. IT INHABITS THE DEPTHS 2000 FEET BELOW THE SURFACE, AND ITS ENTIRE HEAD IS PHOSPHORESCENT.



Photographs Courtesy Harper's Weekly.

THIS FISH, WHICH WAS CAPTURED IN THE ATLANTIC DEEPS, CAN SWALLOW FISHES MUCH LARGER THAN ITSELF, THE STOMACH EXTENDING TO THE TIP OF THE TAIL.

COLOR HARMONY

BY LILA G.A. WOOLFALL

COURTESY OF THE HOUSE BEAUTIFUL

Harmony, in the general use of the word, has so long been associated with musical tones and discords, or when applied to individuals has referred to the mental status of each to the other, that many times the casual observer or think er overlooks the really benad adaptiction of the word when it is used reconnection with inanirrate objects. A lock of barmony in these will often be found to provide the basic element upon which a distressing want of it between individuals is founded, and often with an entire ignorance on the part of both that something quite foreign to themselves has caused the brech. There are some natures so keenly alive to the harmonious coloring about them that when a sharp or badly combined contrast is forced upon them the impression carried to the brain by the offended eye can only be likened to the effect produced by discordant notes upon the sensitive ear of the trained musician.

Take the beautiful arrangement of color in the rainbow. The spectrum provides the foundation of all colors, but the eye is led by gradual changes from one extreme to the other without the shock of

any sudden contrast.

Although color is probably the most important and at the same time the most indefinable adjunct to harmony in household arrangement, form follows it very closely. Too much design interwoven in rugs, draperies and wall coverings, without sufficient plain surface as a balancing factor, will offend the eye, and therefore weary the brain, almost as quickly and quite as infallibly as the lack of color harmony, also less insidiously, as it is more easily recognizable; just as some people do not know that they are color blind, so others fail to perceive what agency is at

work to cause mental unrest, when they are surrounded by colors which grate upon their sensibilities.

In considering this element of form we might say that *incongruity* of form and purpose cause the greatest lack of harmony. What might be quite appropriate in one place or apartment, or designed for some special purpose, would give offense immediately if wrongly placed, or devoted to some use foreign to that for

which it was designed.

In bringing this article to a close there are a few words bearing upon the relations of certain colors to various apartments and temperaments which will be appropriate to the present line of thought and suggestive of further discussion. Gray as a foundation color in house decoration is now receiving its meed of appreciation, but it should be the warm, drab gray in which one feels the brown and yellow tones without really seeing them. A cold gray makes one feel as though confined behind stone walls.

The country residence of one of our multi-millionaires is furnished throughout with gray walls, the color of each room being given by the rugs, draperies and upholsteries, for which the walls provide a charming background. Gray gives an effect of distance, and therefore enlarges a room, apparently, and as it also subdues the rays of light, is much more suitable for a room with southern exposure than green, which is so often used and so surely fades. Gray, with green, blue or lavender provides a most restful atmosphere in a sunny apartment, and combined with the warmer colors will lend itself pleasingly to rooms where less sunlight enters. However, in a north room, or one from which sunshine is for any reason excluded, a

creamy yellow it which chrome tints are distinguishable, will give an effect of sunlight. A charming room in blue and grav is furnished in the following attractive manner: A quaint old chintz striped paper forms the wall decoration up to the monotoned frieze, which is a drab-like gray, to match the ground of the paper. The strip is formed of little old-fashioned blue blossoms and tiny deep red rambler roses, giving a touch of enlivening color. Couch cushions and window draperies are of old blue Scotch fabric, as are also the upholsteries of the rattan chairs painted drab, together with the desks, tables and other articles of furniture set against a rug which incorporates in itself all the tones of color in the room. The result is a combination of restfulness, charm and beauty, which are conducive to the highest form of concentration. If this element of color treatment could be enlarged upon

successfully in the decorations of private offices as well as in some surroundings, much more satisfactory results might be attained.

Too much gray or lavender might depress a quiet or low-spirited personality, while it would serve to balance better the gay and lively temperament, which would only be further excited by the brilliant

hates of rede or yellows.

Greens, frowns, tans and grays, with old blues or lavenders, are conducive to restful effects, while reds, yellow, terracottas, old rose and the richer tones of color contribute to warmth and cheerful-

A combination of all these arrangements which is likely to please every taste and therefore especially adapted to the furnishings of living-rooms, is the touch of Orientalism which is the acme of combined color.

ESTIMATING THE LIFE OF AN ELECTRIC INCANDESCENT LAMP



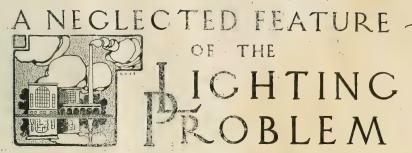
BY D° ROBERT GRIMSHAW



A new German device has for its object showing on a scale the probable duration of a type of electric incandescent lamp. Of course, devices for this purpose are already known to manufacturers and others; making use of substances which are sensitive to either light or heat as an index. The new type, however, employs materials which are sensitive to both heat and light, or to heat and chemical action. There is a tubular stand containing a liquid column, which latter, when the lamps burns, is made to mount, and at the same time exerts a chemical action upon another substance contained in the tube, or passes beyond an opake zone and is

acted upon by the light rays from the lamp; the amount of the change determining the illumination (and thereby the probable duration) of the lamp; these being read off from a color scale. By employing at the same time the action of the light and heat, or of light and actinic rays, there is claimed to be secured a greater degree of accuracy, whereas the action of light alone might lead to false conclusions.

The action of the heat can also be employed to evaporate a substance contained in the tube, so that the vapor rising in the latter can exert a chemical action, (such as coloring, altering color, or bleaching) on a substance contained in the tube.



BYILKIALWOOD

Since the earliest form of the incandescent light was placed on the market new inventions and improvements in old design have been so frequent that a comparison of the artificial lighting of to-day with that of five decades ago would make some startling revelations. Thanks to the unceasing activity of such large manufacturers of electrical apparatus as the General Electric Co. and the Westinghouse Company, as well as the specialized work of such men as Edison, Tesla and others, the problem of interior illumination by artificial means has to all intents and purposes been entirely solved.

Workmen in large factory areas, such as in machine shops, textile mills, and similar manufactories, are supplied with individual and combination clusters; with small portable lights; with all sorts of apparatus for condensing light on a certain part of the machinery, and other artificial aids to eyesight; so that there is scarcely any requirement of artificial lighting encountered to-day for which there is not some adequate form of equip-

From 60 to 70 per cent of a working day, however, does not depend upon artificial means of illumination. And it is at this point that a neglected feature of the lighting problem is discovered. Far too little attention has been paid, at least on the part of the American manufacturer, to the subject of natural illumination; to seeking out the best ways for getting all the daylight possible into the remotest nooks and corners of his manufacturing plant; to capture the cheerful influences of outdoors and transfer them to the

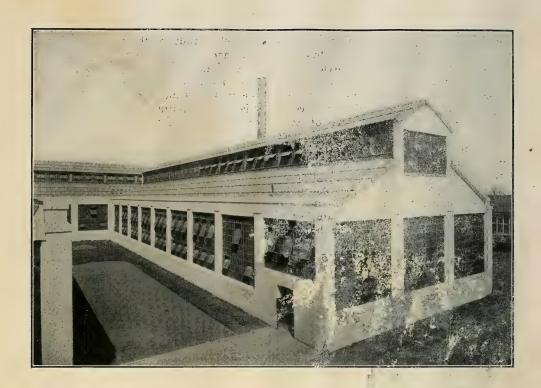
ment.

terior of his establishment, for the direct benefit of his own workmen.

There is a five-year old idea abroad in the country at the present time, however, which is making full allowance for, and has for the center of its consideration, this very factor of better natural lighting. The prevalent idea in American factory construction has largely been to supply small wooden windows, as few in number as possible, consistent with carrying on the work inside. Walls of brick and wood and, in exceptional cases, of concrete, were used to the greatest possible extent, supplying a needless amount of additional solidity and strength to the fabric of the building itself, without conferring any benefits on the workmen inside. The idea of bettering such conditions, already mentioned, was partly due to our bias toward reform, but principally brought about by the transfer to America of methods that were in common practise in Europe. In other words, the idea of manufacturing steel windows in combinable units, for all classes of industrial lighting.

Installations of solid steel windows, which replace with their lighting areas almost 90 per cent. in some cases, of the original brick or wood wall area, have been in use in Germany and England for scores of years; in fact, a very interesting iron window of this general type of construction can be seen in America, which was used in the Tower of London eight hundred years ago—a marvelous instance of the durability and timeproofness of such windows!

Steel windows have, of course, been



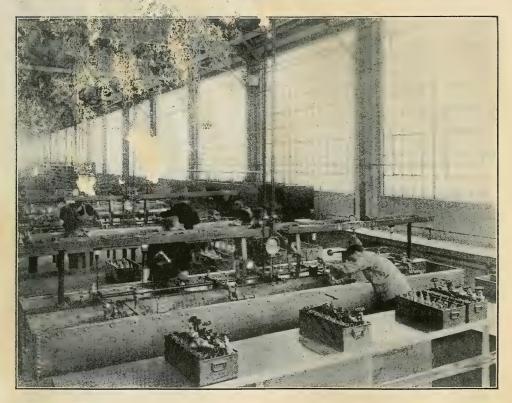


TWO EXTERIOR VIEWS, SHOWING APPLICATION OF STEEL WINDOW FRAMES, ASSURING MAXIMUM WINDOW AREA.

made in this country for forty or fifty years; practically all of them, however, being of the same general style of restricted openings and heavy framework which characterized the ordinary wooden sash. Due to the foresight of three or four American manufacturers of solid steel windows which could the carabined into units of one hundred square feet or more lighting surface, the neglected factor of natural lighting was at last given its share of importance in the equipment of modern buildings. Imaging, for instance, a single window of Lagons square feet of steel and glass. Such is the Lanting!

a careful study to the factor of natural light and the results of their investigations satisfied them that in terms of industrial efficiency they could well afford to give the idea of window walls this thorough trial on an each lous scale. The results have justified heir beliefs. The New York Central has informed the manufacturers of these windows that they will continue their use in all future work.

The Hudson Motor Company of Detroit also welcomed this idea of converting their side walls into steel-and-glass windows. The eeffct of working in such a construction is equivalent to remaining



VIEW OF INTERIOR WHERE, OWING TO GOOD NATURAL LIGHTING CONDITIONS, IT IS A PLEASURE TO WORK. A COMFORT TO THE EMPLOYEE AND GREATER RETURNS TO THE EMPLOYER.

sight presented by the side walls of the New York Central and Hudson River Railroad shops at West Albany, N. Y., which are equipped with these new style steel windows. It was not for the mere beauty of appearance either that such a construction was adopted by those practical minded railroad engineers. They gave

outdoors, while at the same time being sheltered from inclement weather, rain, wind, etc. To work in that atmosphere all day long of abundant daylight and fresh air is to be given the nearest approach to an outdoor life that is possible for indoor workers to secure.

The new steel windows are equipped

with ventilators, swinging in horizontal or vertical planes, and inserted in any part of the window framework that the purchaser desires. Buildings windowed in this fashion with steel and glass in place of brick or stone walls represent the final solution of this neglected problem of natural light. Nor do the advantages of such a construction end at this point. Such buildings are almost self-insured, so far as walls are concerned; they are fireproof; there are no expense bills for repairs, replacement, corrosion or decay. The uniform splendid lighting does away with the accidents usually due to carelessness or poor light. Finer work, such as that done on lathes and presses, as well as inspection, painting, etc., is facilitated by the bright natural light. More machines can be placed in a given floor area than before, because there are no dark spaces which cannot be utilized.

In view of such superiorities, the equipment of any building with steel windows in place of walls, represents an immense economy, although the average reader would imagine the expense over wooden windows to be a striking obstacle. In the case of a large automobile company in Detroit, employing more than a thousand men, this economy has been only too well demonstrated by actual facts. After moving into one of their buildings equipped with steel and glass walls of the general type already described, they found they could reduce their working day from ten to nine hours, while still maintaining the same amount of pro rata production.

The reader can figure for himself the annual saving in workingmen's wages alone which such results offect. A thousand men working on a fow wage scale of 20 cents for hour, save their employers one hour of time each, for 300 working days. The total figure reaches \$60,000, which is a dollars-and-sense argument for this new type of natural lighting equipment-solid steel windows which no sane manufacturer would think of overlooking. The factory manager of this particular company was called in and asked if this equipment of new windows represented to him five minutes' additional daylight during a working day. He replied that this was an absurdly low rating for the added light they received, stating that the difference was much nearer an hour or hour and a half per day. However, on this very low basis of five minutes per day gained in light, figuring 20 cents to the working hour, it was found that this company had made a profit at the end of the year of 125 per cent. on these solid steel windows over the original purchase

All in all, actual experience has shown that the new type of natural lighting has come to stay. It is the biggest asset of the manufacturing builder. There is not an element of unprofitableness connected with it, and viewed either as an item of philanthropy or of hard-headed commercial investment, it is the final solution of that neglected factor of the lighting problem—how to give the indoor working world more natural light.

The Use of Marble in Lighting

It is reported that patents have been recently taken out in Germany for using marble instead of glass in lamps, which medium has the effect of making the illumination scarcely distinguished from daylight.

A number of experiments have been made with tinted and patterned types of glass with the idea of producing this effect. Marble was planed down until it was somewhat transparent, and then different intensities of light were shown from behind. The result was exactly what so many hundred of experiments had failed to produce. Developing this discovery, the inventors fitted lights to the cornice of a room so that it is difficult to realize that it is artificially lighted.

DARKADAPTATION OF THE EYES

BY PROF. FRANCIS GOTCH, F.R.S.

It is a familiar experience that on coming from daylight into a darkened room there is at first great difficulty in seeing faintly illuminated objects which in a short time become plainly visible. This phenomenon is mainly associated with an alteration in the receptive structures of the eyes, which gradually become "adapted" to the dark environment, and are rendered much more sensitive to feeble light.

Home & But Garage

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A further equally familiar experience is the visual confusion associated with a sense of dazzling glare, which occurs on coming suddenly from a dark room into bright daylight; this also passes away as the eyes return to their daylight state of adaptation.

THE EYES IN THE DARK AND IN THE LIGHT,

The eyes in the dark differ from the same organs in daylight in two respects, both of which increase the sensitiveness of these sense-organs to feeble light. The first is the dilatation of the pupils, allowing more light to reach the sensitive surface (retina); the second is a peculiar alteration in the retina and in the sensitive structures which it contains.

The cellular elements of the retina which form the peripheral sensitive structures are of two types, cones and rods. These lie on the most posterior (deepest) border of the retina, where they are embedded in pigment cells; they have stalks connecting them with more anterior layers of the retina. In man the center of the retina (corresponding with the center of the field of vision) contains scarcely any rods. This central part (fovea) is crowded with cones; it occupies an area of relatively small size, so that when one luminous point is focused in the middle a second point would be focused on the edge of this region when the two points subtend an angle of 11/2° to 21/2°.

Around the edge of this region the retina contains both rods and cones, which soon become almost equally numerous for some little distance (probably for 2° or 3°). This part may be termed the parafoveal region, and shades off into the remaining peripheral parts of the retina, in which the cones are greatly diminished in number and the rods greatly increased, until finally only rods are present.

In a large number of vetebrates, particularly in many birds and fishes, pronounced changes in the form of the individual cones and rods have been found when eyes previously exposed in daylight are compared with those previously kept in darkness. With daylight the anterior stalks of the cones are diminished in length so that the cones are brought forward nearer the source of light, while the stalks of the rods are increased in length so that the rods are thrust back further from the source of light. Moreover, a third set of elements, cells containing pigment, is affected by light, the contained pigment streaming forward in large quantity until it forms a screen immediately behind and around the cones, and thus lies en masse between these and the lengthened rods. Similar changes, on a reduced scale, have been observed in many mammals, including the monkey, and probably occur in

All the above changes are reversed in the case of eyes kept previously in the dark. Hence, in the daylight eye the cones are more favorably situated, but the rods less favorably situated, for stimulation by light, while in the dark-adapted eye the rods are at least as favorably situated as the cones. The rods are probably more readily acted on by weak light than the cones, since they contain a special pigment (visual purple), which is a sensitive photo-chemical compound; and the visual purple alters to light, particularly when this is of sufficiently short wave-

length; thus red rays are nearly ineffectual, while green and blue rays cause marked changes.

FUNCTIONS OF RODS AND CONES.

The above facts, taken in conection with the peculiarities of vision in the darkadapted eye, with the very scanty number of cones in night birds (owls, etc.), and with the very scanty number of rods in day birds, suggested to Von Kries his hypothesis as to the different functions of the two structures. According to this the cones are the sensitive structures aroused by all visible light waves, giving rise to the ordinary color sensations (and in combination to white), while the rods are extremely sensitive to all light waves of sufficiently short wave-length, and give rise to sensations not of color but of various shades of white. These come into play in the peripheral parts of the darkadapted retina, increasing the perception of faintly luminous objects, but without giving rise to distinctive color sensations.

SENSITIVENESS OF RETINA TO LIGHT.

White light subtending large areas (5° or more) may be perceived at night or in the dark room when the light itself is even several hundred times less in intensity than the minimum low limit which can be perceived by the light-adapted eye. This great increase in sensitivity is not shared equally by all parts of the retina, for if white light subtending small angles (30" or less) is employed, it is found that on the center of the field of vision (fovea) the increased sensitivity is comparatively slight, but on the peripheral parts of the visual field it is very marked. Thus a feeble star, scarcely visible when looked at directly, becomes bright when the visual gaze is directed to another star a little way off, in which case the image of the star is focused several degrees outside the center of the retina.

Colored Lights.—In the dark-adapted eye the stimulation by colored light of the extra foveal part of the retina, containing a considerable amount of rods, gives rise to peculiar modifications of visual consciousness.

(a) On looking directly or a little obliquely through a spectroscope of wide

dispersion in a dark room at a very faint source of light, visual sensations of a uniform character as regards color are produced when the eye have become sufficiently dark-adapted. The spectrum may finally appear as a gray white band, with its brightest part in the region which under ordinary conditions would appear blue-green. No light at all or a mere fringe of dark gray is seen in what would correspond with the red end, while the part which corresponds with yellow appears as a rather dull gray.

(b) If the eye is fixed in the dark room on one small spot of light and a second small colored light is flashed out at some little distance, then the sensation produced by this varies with the position and hue

of this second light.

If the second light is spectral green or blue, and is some degrees away from the first light (this last being fixed by the visual gaze and thus in the center of the field of vision), the second light gives rise to a sensation of rather dazzling white. This is especially the case when the light itself is of very small angular area. The sensation continues when the second light is moved nearer the first, and tends to mask any recognitition of green or blue color. In my own case such color recognition may not occur with the Board of Trade light-green light until this is focused on the retina within 11/2° to 2° from the center, when the dazzle disappears and the color becomes quite plain.

If the second light is red, then neither the color nor the light itself is recognized when it is so situated as to be focused on the retina over 8° or 10° outside the central fixed one. In my own case with a dim Board of Trade light-red, the limit of failure of color recognition was a little under 60°. Beyond such recognitionlimiting distance there was no sensation of white dazzle, but a barely perceptible dull gray spot was sometimes seen instead of the red light. Further out this light became quite invisible. When brought as near as 6° it always showed as a distinct red spot, and continued so however close it was brought. There was no simultaneous white dazzle to mask the hue; thus the light, if visible, was easily recognized.

A number of experiments on individuals ascertained to possess normal color vision support the view that in the dark-adapted eye red light is recognized as red over an area whose radius is three or fear times that observed with green light; yet the red light is not seen at all outside this larger area. On the other hand, green (or blue) light, while it is only recognizable as green over the much more restricted central area, is seen as a bright light of a dazzling white type over a very extensive area.

As illustrations of such visual phenomena in connection with what is termed "dark adaptation perimetry," I append a few experimental results obtained from ten different observers, all with normal color vision.

ANGULAR DISTANCES FROM CENTER WITHIN WHICH THE COLOR OF A SPECTRAL LIGHT 30" DIAM. ETER WAS RECOGNIZED.

0	hserver	Rec	T.io'l	ht.		Gree	n Lis	rh t	
_	1	Within		or	7°	Within		or	20
	2	6.6	71/2°	6.6	81/3°	64	11%°	6.6	21/20
	3	6.6	96	6.6	10°	44	21/2°	6.6	31/20
	4	44	6°	6.6	70	66	26	1.6	21/20
	5	6.6	7°	6.6	8°	4.6	$\bar{2}^{\circ}$	4.4	36
	-6	4.6	8°	4.4	9°	64	$\bar{2}^{\circ}$	6.6	21/00
	7	4.6	8°	4.6	9°	66	21/3°	6.6	36
1	. 8	4.6	81/9°	6.6	91/60	44	21/20	64	30
	N. 9	4.6	6°	6.6	71/20	44	26	66	21/00
	10	66	8°	66	962	66	$\bar{2}^{\circ}$	66	21/20

It may be added that with the red spot of light any recognition of light immediately beyond the sensitive limit given above was very doubtful or non-existent, although with practise a dull gray spot can be perceived for a short distance. On the other hand, with the green spot of light there was, from 3° outwards, most definite recognition of light over a very large area, the appearance being a white or bright dazzle. This was also present with blue light, but the hue was unrecognizable as regards both blue and green. Yellow light also gave the same bright dazzle; it was often blended with a reddish sensation if it lay from the center about 3° or 4°.

The recognition of small areas of red or green by the dark-adapted eye is, as regards color, thus only possible when these are focused near the fovea, i. e., lie near or at the center of the field of vision. This is particularly the case with the peripheral vision of green; presumably these rays, by exciting rods, evoke a sensation of white, which has a dazzling effect and

masks the true color. Such white dazzling sensation is still present, but to a less degree, as the green light approaches the center of the field of vision, but it ceases when this light is 1° to 2° from the center. According to Von Kries the explanation is the differential stimulation of both rods and cones, that of the rods giving rise to the dazzling white sensation in addition to the color sensation produced by the stimulation of the cones.

RECOGNIZING COLORED Lights NIGHT.

The eye being dark-adapted, the foregoing peculiarities of visual sensations must affect the recognition of colored

lights at night.

(a) White or Yellowish Distant Lights.—At sea on a dark night there are no obvious distant objects to definitely fix the visual gaze, and the eyes wander, searching the horizon. Attention will be first attracted during this search when a distant small white light is so situated with regard to the visual gaze as to be looked at somewhat obliquely; it may then appear quite bright. The eyes will now turn towards its source, so as to bring it into the center of the field, but since this central region is in the dark-adapted eve much less sensitive than the peripheral part, the light will become dim and may even be invisible. By means of a binocular it will become visible and be recognizable at once as a small white or yellowish light. The dark adaptation must thus facilitate the picking up of small distant white lights at sea, owing to the great sensitiveness of the peripheral parts of the retina containing rods, which by dark adaptation are favorably placed for stimulation.

DIFFERENCES OF GREEN AND RED.

(b) Green (blue) Lights.—As in the previous case the eyes in their search will be first effectually stimulated if a distant small green light is looked at obliquely and its image is thus focused on parts of the retina lying outside the fovea, i. e., center of the field of vision. A visual impression of a rather dazzling white light will now attract the attention. On gazing directly at the suggested position of

the source it is very probable that no light will be seen, but if it falls on the retina a little way off the center of the field it will reappear and give a confused blend of white dazzle with a greenish tinge. The resemblance to white or yellowish distant light will now confuse the judgment, and this confusion will continue until the light grows sufficiently bright by coming nearer as to be seen in the center of the field of vision, when it will appear an unmistakable green. By means of a binocular this last result is more easily achieved and recognition is more undoubted.

(c) Red Light.—In this case the image of the light must fall within about 10° of the middle of the retina to arouse any sensation, and on attention being then directed to it such light will appear unmistakably red. Inasmuch as there is no white dazzle sensation to confuse the judgment, both the picking up and the recognition are approximately simultaneous, and both are favored by the comparatively large retinal area, 16° to 20° in diameter, within which the red response can be evoked.

Experiments seem to show that in some individuals with normal color sensations the size of this area may be considerably reduced; in these cases there might be more difficulty in picking up a distant small red light.

From the above differences between red and green recognition in the case of small distant lights the conclusion may be drawn that accurate focusing, while an important factor in all color recognition, is particularly important for the recognition by the dark-adapted eye of distant small green lights. These must be accurately focused upon a relatively small area around the center of the retina if they are to produce the appropriate color sensation, otherwise they will always produce an extensive white dazzle, which must more or less mask the color and confuse the visual judgment. In practise the use of binoculars is probably relied upon for recognizing the hue of distant colored lights of small area, but a possible aid to such recognition is the circumstance that in any doubtful case, if the light, apart from its color, is better seen by oblique than by direct vision, then it is green or white; if better by direct than oblique vision, then it is red. That it has been shown that the French rad ship-light is visible on the center of the visual field twice as far as the French green ship-light, but the Brench green ship-light is seen as a white dazzle in the outer field of vision four to five times as far as the red is on the center of the field.

Dark Adaptation and the Color Blind.

The phenomena of dark adaptation occur in golor blinds as in normal individuals. It is the cones, not the rods, which, on Von Kries' hypothesis, are the first links in the chain from the retina to visual color consciousness. In accordance with this conception it is most improbable that dark adaptation should assist color recognition in cases of color blindness or color deficiency. It may, indeed, be inferred that dark adaptation, instead of giving any parceptible assistance, would increase the inability of the color blind to recognize some given color when other clues derived from extraneous sources of light are removed by the dark environment.

Supposing, however, that there is a certain deficiency or weakness in red recognition, this will involve more practical incapacity in the dark-adapted state than a similar weakness or deficiency in green recognition, for a distant small red light evokes a response when it falls upon the less sensitive parts of the dark-adapted retina and with weak reacting power to red, this kind of light might be thus either invisible or a dim gray. The ship signal red has, moreover, a yellow portion which may evoke a white sensation, such as is caused by green of low luminosity, and thus be confused with a dim green.

Considerable green deficiency must be serious, but from what has been already said as to the difficulty of recognizing this light in the dark-adapted eye, when small dim lights are observed, it is probable that persons with clearly indicated but not marked green deficiency may, when dark-adapted, be not much worse off than normal individuals as regards failure of color recognition.

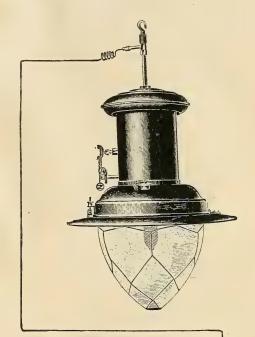
Even normal observers, when they are dark-adapted, may have to form judg-

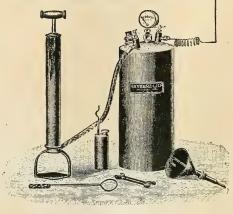
ments as to the has of distant small green lights, after taking into account the white deazle, which such lights nav show if viewed obliquely. It is not improbable that the green-weak individual may come to rely upon this peculiar white deazle, and through experience may be able mus

to draw correct conclusions as between green and red lights. There will, however, be a great tendency for such an individual to confuse a green with a yellowish-white light, since both of these ruight give a white dazzle without any tinge of color.

THE "OXYBENZ" INCANDESCENT BURNER BY DR ROBERT CRIMSHAW

The benzol and compressed air burner known in Germany by the name of its inventor, Fernholz, has been improved recently-it is of the inverted type, and has no benzol reservoir; the fluid being contained in a tark alongside or at the foot of the mast, and from which it is delivered by compressed air, as desired. The i'w ramp has showed itself to be proof against wind and rain, burning steadily even in the heaviest storms. The body is of enameled iron; the constructionsimple. The incandescible mantles are not previously burned; this reducing materially the cost of up-keep, as there is no risk of breaking down the mantle in applying it. The candle-power is regul lated by varying the amount of air-supply through the small flexible metal tube connecting the burner with the benzol reservoir. This lamp is constructed for house as well as street use; and there is a size adapted for the table; the latter style using only 18 grams (278 grains) of benzol per hour, and delivering about 60 normal candle-power. Those for external use are rated at 200 to 2,000 c. p., according to the size.





THE EVOLUTION OF THE LICHTING FIXTURE

BY GRACE NORTON ROSÉ WITH DRAWINGS FROM THE ANTIQUE BY J.M.ROSÉ

From the rose-shaded reading lamp of my lady's bedroom, the Sheffield silver sconces of a paneled banquet hall and the claborate alabaster lights of the modern ballroom is a long backward leap to the little clay handlamp of the early Egyptians.

Palace and hovel fared alike in regard to illumination, and while there is a distinct mention of lamps burning all night long among all the ancient races, we are certain that the actual light-giving properties were not of the best. Prior to this, slips of pine were burned in a sort of chafing dish; but vegetable oil, especially olive oil, and salt it is known was used at an exceedingly early date. The wick of hemp, flax, or tow, floated in this fluid, and gave forth its sickly flame and trail of blackening smoke. Tallow and wax candles were not successfully made in those days. In the sacred lamps only the choicest oil was burned, and the wornout linen dresses of the priests were raveled to furnish the wicks. The lamps themselves were invariably tiny; some of red clay, and others doubtless of glass. The clay was often ornamented with fanciful designs in color. Crude as these fixtures undoubtedly were, the shapes have the beauty of utility and adaptation, and the few examples that have come down to us are well proportioned and pleasing in form.

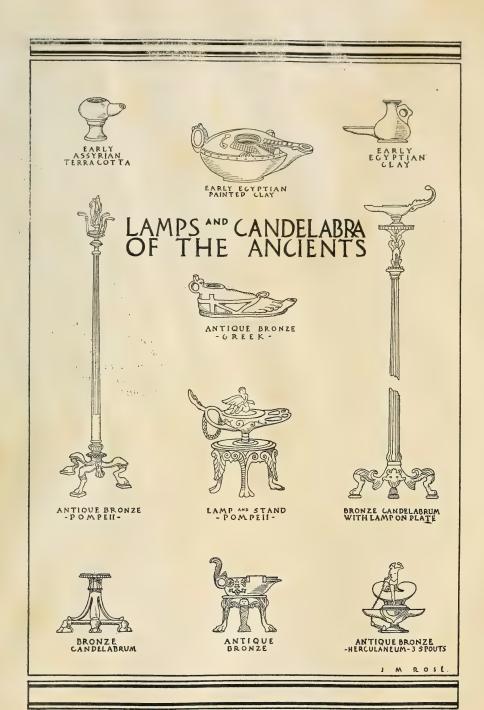
In Assyria, the terra cotta and bronze used took general shapes similar to those of Egypt, but lacked, perhaps, the finer modeling and embellishment of those ancient craftsmen.

We are all familiar with the description of the seven-branched golden candlestick of the Jewish nation, and among them also was found the hanging lamp, the special lamp of their Sabbath eve lighting.

Among the Western Asiatics animal fat was used and burned in a vase with a floating wick.

It was the Greeks who first made their lamps and candelabra true things of beauty, and many wonderful examples of bronze stands and lamps have been found among the ruins of buried cities. More attention seemed to be paid to the exterior forms than to the principles of combustion, and it was several centuries before it was discovered that by placing the wick in a spout extended some inches from the body of the lamp, less shadow would be cast. The ancient Greek writers make no mention of candles, though the practise of carrying torches or flambeaux out of doors receives much comment.

The Roman populace boasted both candles and oil lamps, though the candlesticks of the poorer classes were of wood and those adorning the palaces and temples often of gold, a not altogether satisfactory metal for the purpose, but costly enough to commend itself to the luxuri-The candles were chiefly slips of papyrus or rush smeared with pitch and dipped in wax. Tall candelabra of marble or bronze adorned the dwelling houses of the patricians, and upon the disk or plate of these the little bronze lamp was set. These candelabra were movable, and also often adjustable to any height, so that a reader reclining upon a couch might regulate the light to the best alvantage. Occasionally the lamps were placed on a lower tripod, and frequently they were suspended from the ceiling. The selfindulgent and epicurean Roman endured considerable discomfort and some annovance from a choking, wavering smoke and consequent dimness of light from this source of illumination. At that time the chimney and its great advantages had not been discovered. It was at the bridal



of Catinus that sweet scented oil was burned, but it is a question if a combination of perfume and soot added much to supplest forms, bears much close study the pleasures of the guests.

The exquisite grace and delicate model-; Extures.

ing of some of these bronze relics of an age where beauty expressed itself in the from the modern designer of lighting

WHILE the scientists were learnedly explaining why the thing could not be done, they were interrupted by somebody doing it. The Architect and Engineer.



MOST POWERFUL MERCHANT SHIP ELECTRIC SEARCH LIGHT

The accompanying photograph shows 80,000 candle-power electric searchlight of the "Kaiserin Auguste Victoria" of the Hamburg-American line. It measures in diameter 5 feet and has a depth of 4 feet. It throws a ray of light 7 miles on water and when thrown on the sky can be seen 30 miles.

This electric projector is said to be the most powerful electric searchlight ever carried on a merchant ship and was a conspicuous feature of the "Kaiserin Auguste Victoria" when it arrived in New York City. It is stated that this great electric light, which is the largest type ever constructed, was designed for the steamship "Imperator," and has been carried across the Atlantic and thoroughly tested at sea and on entering harbors.

By throwing its beam of light 80,000 candle-power on the Scotland Lightship, on approaching port, this searchlight rendered the name of the ship clearly visible

at a distance of several miles. It is mainin service ready for operation the great trained that this great light is effective for many miles at sea, and when thrown upon the clouds can signal clearly and is visible for a distance more than a score of miles.

This new electric searchlight the "Kaiserin Auguste Victoria" as been carried on the forward deck, out we designed to be instead to the high up on the mainman when it in be quickly swung to any angle, and this electric projector is of the type used heretofore only on the largest dreadnaught battleships. The lens is 42 inches in diameter. It is operated by a current of 13,000 watts on a 110-volt circuit.

It is claimed that this powerful electric light ray has pierced fogs and distinguished distant objects at every point of the horizon in actual tests at sea and will make collision accidents with icebergs impossible in the future, doing away with all chance of another terrible "Titanic" disaster.



LIGHT The Life of Photography By Powell M. Culick

In the last issue, having studied the proportion of the values of skylight, sidelight, and top and side light combined, in the making of photographs which we'ld best bring out the characteristic of the object photographed, let us now consider the subject of light as a whole unit in its relation to the art of picture making.

Photographs are made with the aid of artificial as well as with the aid of solar light. Studios are equipped to take night pictures as well as day pictures, and the up-to-the minute photographer can turn out a finished print ready for framing within an hour after the photograph has

been taken.

In places where it is impossible to obtain a stronger artificial light, the flash pan and powder are brought into use. This aid to photography is used mostly at night, outdoors on "news photo" assignments, or in interiors where it is necessary to have an intense artificial light of great power and magnitude. Most of the night work in studios is done with the aid of powerful arc incandescent lights or else with the aid of the Hewett light or the Blau light, but the most popular light of all, where it is impossible to bring a single ray of solar light is the light cast from the powder pan, when the friction on the cap sets the spark that touches off the powder.

Great care, however, must be exercised with this method, otherwise both the operator and the photographed subject are made to suffer. "He who plays with fire is apt to be burnt," and the powder in the pan is very apt to run down and severely burn the operator, or the report of the flash may startle the subject to such a degree that the results obtained from developing the plate may bring nothing but disappointment.

As stated before, every visible object, whether it be a living breathing person or

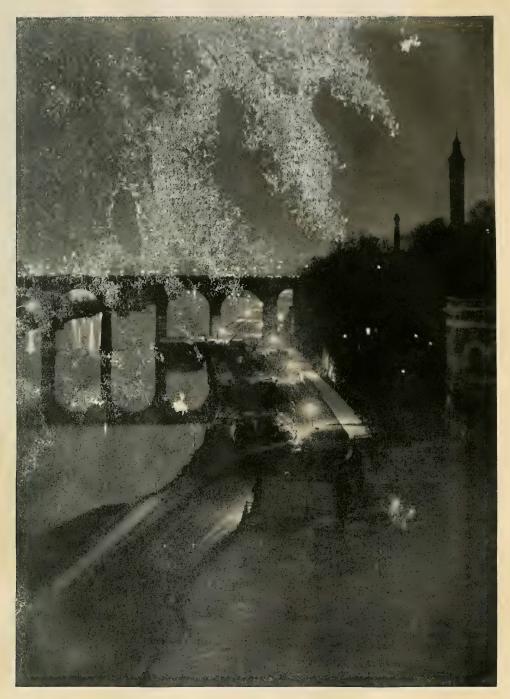
an inanimate object is a light factor, either by its luminous powers or by the powder borrowed from a self-luminous body, so that it is possible, to take pictures that are not only artistic, but full of that "something" which is a joy to the eye and a credit or badge of honor to the photographer, without the aid of any other than the luminous powers borrowed by the object photographed, as shown by this splendid photograph of High Bridge

taken at 9 o'clock at night.

It is, of course, understood that no matter how perfect the equipment of a studio, it is impossible for the studio photographer to put the same amount of life into his photographs as does the man who works under the blue canopy of the "Great Out Doors," where "Light" everywhere dispels shadow and shade, and vet diffuses the proper proportion of both, in giving the photographed object that touch of the Divine Spirit that He alone can breathe into the object, as witnessed by the old farmer driving the spirited young mare hitched to the old-fashioned chaise.

Not long ago the world was startled by the announcement of a new Light Ray -scientifically termed Cathode Raywhile this may be a transition to another subject, still this Cathode Ray is the means by which the eye of the camera is capable of reading "the thoughts," as it were, of the object photographed, and because of this it will not be amiss to consider this wonderful light discovered by Prof. Röntgen, of Germany.

Cathode Rays, or as we are more familiar with them by the name X-Ray, are certain invisible rays resembling in many respects rays of light, which are set free when a high pressure electric current is discharged through a vacuum tube. This is of glass from which all air, down to one millionth of an atmosphere has been



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VIEW FROM WASHINGTON BRIDGE, SHOWING THE HEIGHTS OF MANHATTAN IN THE DISTANCE, WITH
HIGH BRIDGE AND THE SPEEDWAY IN THE FOREGROUND. PHOTOGRAPH TAKEN AT 7.30 P. M.

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X-RAY PHOTOGRAPH OF A HAND, SHOWING NEEDLE IN FINGER.

exhausted after the insertion of a platinum wire in either end of the tube for connection with the two poles of a bar-

tery or induction coil.

When the discharge is sent through the tube there proceeds from the acode—that is, the wire which is connected with the positive pole of the battery, certain bands of light, varying in color with the color of the glass. But these are insignificant in comparison with the brilliant glow which shoots from the tathode or negative wire and excites brilliant phosphorus. It is due to this discovery of the German professor that science must revise, possibly to a revolutionary degree, the long accepted theories concerning light and its phenomena.

A recent demonstration of the maker of four X-Ray machines by H. D. Blauvelt, the official photographer who accompanied Theodore Roosevelt on his trip around the world, made the select party whom he entertained marvel at the in-

genuity of this marvel of science.

With the possible exception of the tube, the apparatus is entirely of his own construction. He very aptly stated, "The X-Ray apparatus is the camera of the high-grade man, and when I had read of this wonderful discovery I resolved that it was up to me to go ahead and make one for use in my own business—taking pictures. I figured that no one could get better results than a man who knew photography from Alpha to Omega, for it takes a good photographer to coax the secret from the eye of the X-Ray machine, whereas any amateur can take a fairly good picture with a camera."

The pictures are made with an induction coil of six-inch spark capacity of his own invention. The coil is especially fine, and is wound with seventeen and a half

miles (think of it) of No. 36 silk-covered wire. There is a Tesla descriptive coil, also a magnetic machine, with glass plates 24 inches in diameter. Looking through the fluoroscope and holding the hand before it the bones of that useful part of the make-up can be plainly seen. After the exposure of the object to be photographed for 25 minutes, the plate is developed, and what the X-Ray apparatus sees through the flesh or in the bone is mirrored on the print.

And now we once against furn to the discussion of the common or garden variety of photography after digging in the

soil of science.

There is just one more phaze of photography lighting I wish to touch on before closing my article, and that is on the subject of the muchly-mooted Rembrandt method of lighting that one hears so much about, yet understands so very little in connection with advanced studio work, unless one is really an expert in this particular branch.

Much has been written and much has been said for and against the Rembrandt

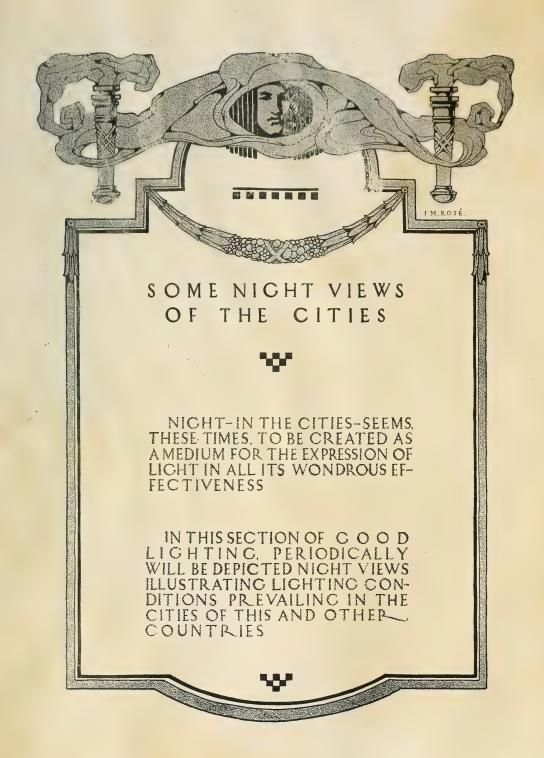
method.

It delineates the expression and brings out those fine points which the artist wishes to emphasize and softens the harsh expression and the ugly lines to such an extent that the photographed object takes on an aspect that one could never reconcile with the subject photographed. In other words, Rembrandt lighting is nothing more nor less than the reading by the camera, between the lines, and the exposure of what lays hid away unseen to the naked eye, yet transformed into a thing of beauty when transferred to a print.

In another issue the subject of Rembrandt lighting will be fully described.

Searchlight on Repair Wagon

A new wrinkle with the Dayton Lighting Company is to equip one of its electric repair wagons with a searchlight for after-dark emergency work on its pole lines. The truck is run alongside and its beam, directed at the pole top, enables the lineman to make connections as conveniently as in daylight.





Courtesy The Denver Gas & Electric Light Co.

SECTION OF DENVER'S GREAT WHITE WAY. THEATRE STOWN ON RICHT 12 3 . 50 000 CANDLE-POWER ON ITS FRONT.



Courtesy The Denver Gas & Electric Light Co.

VIEW OF FIFTEENTH STREET, DENVER, SHOWING COMBINATION LIGHTS ON TROLLEY POLES AND THE DENVER GAS & ELECTRIC LIGHT COMPANY'S BUILDING TO LEFT.

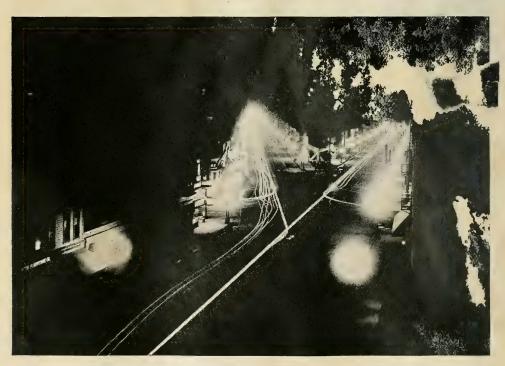
A VERY UNUSUAL VIEW OF NEW YORK BY MODNLIGHT,

Courtesy New York Edison Company,



Courtesy Commonwealth Edison Company.

BLUE ISLAND AVENUE, CHICAGO.



Courtesy Southern California Edison Company.

LOS ANGELES, CAL.
646



Courtesy Union Electric Light & Power Company.

BROADWAY, LOOKING NORTH FROM THE THIRTEENTH FLOOR OF THE TIMES BUILDING, BROADWAY AND CHESTNUT, ST. LOUIS.



Courtesy Edison Illuminating Company of Boston.

COMMONWEALTH AVENUE, BOSTON.



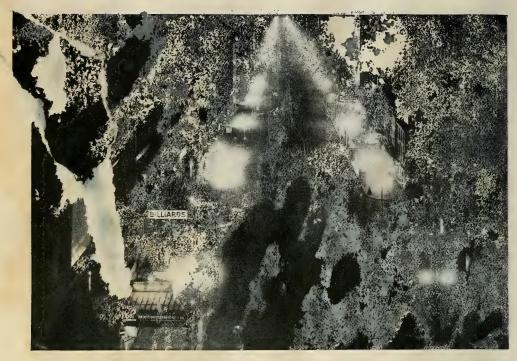
Courtesy Consolidated Gas, Electric Light & Power Company.

CHARLES STREET EXTENDED, LIGHTED BY GAS LAMPS.



Courtesy Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

BATTLE MONUMENT LIGHTED FROM BASE.



Courtesy Philadelphia Electric Company.

CHESTNUT STREET, PHILADELPHIA. VIEW FROM CITY HALL.



Courtesy Lighting Department, City of Scattle.

CLUSTER LIGHTING IN SEATTLE.



Courtesy Central Hudson Gas & Electric Co.

MAIN STREET, LOOKING EAST FROM MARKET, POUGHKEEPSIE, N. Y.



Courtesy The Pueblo & Suburban Traction & Lighting Company.

SOUTH UNION AVENUE, PUEBLO, COLO.



Courtesy Edison Electric Company

REET, LE CASTER, PA



Courtesy Commonwealth Edison Company.

CARNIVAL ILLUMINATION, WEST TWENTY-SIXTH STREET, CHIC



BIRD'S-EYE VIEW, WEST MADISON STREET, CHICAGO, ILLUMINATED. Courtesy Commonicealth Edison Company.



Courtesy Commonwealth Edison Company, Chicago.

WILSON AVENUE, CHICAGO, DECORATED.



Courtesy Syracuse Lighting Company.

ORNAMENTAL LIGHTING, LOOKING EAST ON GEHESEE STREET FROM SALINA STREET, SYRACUSE, N. Y.



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NEW YORK'S "GAY WHITE WAY."

View looking north from Thirty-third Street and Sixth Avenue. On the left is Gimbel's and Saks. On the right the new Hotel McAlpin. In the foreground is the Thirty-third Street Station of the Sixth Avenue "L." In the center the Herald Building and in the distance the Times Building.



Courtesy The Denver Gas & Electric Co.

CURTIS STREET, DENVER.



Courtesy Commonwealth Edison Company.

MILWAUKEE AVENUE, AT ASHLAND, CHICAGO.



Courtesy Consolidated Gas, Electric Light & Power Co.

BALTIMORE, MD.

MOVIES

The exect of a picture thrown by a lantern upon a flat surface, where it is to be viewed by a large number of persons at once, depends on the brilliancy of 'the light. This is affected by three factors: the original intensity of the source, the size of the picture as projected, and the reflecting quality of the surface. The stronger the light-source, the brighter and clearer the picture will be. The more the light is spread out over a large area on the screen, the less brilliant it becomes. And finally, the more light the screen reflects and the less it absorbs, the better will be the result. It is apparent that if we are to exhibit a very large picture, the lightsource must be intense or the screen of the lets are fastened. This screen is high reflecting power, or both. The available sources of light having about reached the limit of their intensity, inventors are the rolle up without inconvenience which now turning their attention to increasing facilitate attion.

the reflecting power of the screens, with the reflecting power of the screens, which the reflecting power of the screens of what success is shown by a note in Cosmos, this screen, he can be screen ordinary postal screen called the "Fulgor," coated with cards may be thrown, and even cinema cards may be thrown. screen called the "Fulgor," coated with metallic particles. We read:

"To obtain very brilliant projections with a considerable enlargement, a powerful illumination is required. This is why constructors have sought to perfect the sources of light, passing successively from the petroleum lamp to various types of incandescence, then to the oxy-hydric and oxy-acetylene lamps, and finally to the electric arc.

The results obtained are already very remarkable. But constructors have desired to do better still; and not being able to increase the brilliancy of the sources indefinitely, they have been seeking to improve the surface on which the images are projected. The simple muslin was first replaced with canvas coated with a layer of white; then ground glass was tried, and finally the metallized screen.

last is far superior to white canvas from the standpoint of lumipous efficiency, and to ground a s, which is too fragile. The great differ y was to find a coating that will give nigh tuminosity, not scaling off, and fet easy to apply at a reasonable

"The projection service of the Bonne Presse has placed on the market a metalized screen of aluminum powder, the "Fulgor," which has all the qualities, de-

sirable in this kind of screen.

"The general appearance is that of a piece of flexible fabric, resembling gilcloth, presenting a silvery surface of great uniformity framed in a black margin in which way as the ordinary varieties, and it may

graphic views, with a simple oxy-essence

"There is one experiment that shows especially the great improvement that is realized: it consists in projecting a plate on a screen made of three sections—one of ordinary muslin, one of canvas made opaque with a white varnish, the third of metallized fabric. Thus may be seen perfectly the respective values of each specimen. The report of the official test made in the laboratory of the Arts et Metiers shows that the 'Fulgor' is 3.7 times as luminous as the muslin and 2.9 times as the opaque screen (the 'Phoebe').

"The only inconvenience of the new screen, which it shares with other existing types, though in a less objectionable degree, depends on its nature. The 'Fulgor' is so luminous because it absorbs

very little of the acident and reflects almost all or it. But it reflects chieff in a directive at right as it the surface and not so itch oblique. Thus the spectator sees very well if he is it one side. Projections may be made it a long, narrow hall, or the spectator may

be warned not to occupy seats too far to one side.

"Thanks to this remarkable form of screen, operators may now greatly increase the size of their pictures or may use less powerful sources of light, or again, by preserving the old size and intensity, may improve the brilliancy and the effect of their views."—The Literary Digest.

MIRRORS FOR STREET CORNERS

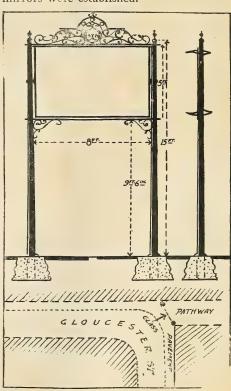
The Municipal Journ recently referred to an idea which so rar does not appear to have been utro-coed in this country, same first finding expression in England. The object lying to prevent collision of teams at afreet intersections

MIRROR AND SKETCH OF LOCATION, MALMESBURY

or angles, and the device by which this is effected consists of a mirror fixed on a building or supported on posts at such an angle that those driving toward the intersection along either street may have a view of the intersecting street. We read:

"A. E. Nichols, borough engineer at Folkestone, states that he fixed a reflector 24 in. sq. at a street intersection, this reflector or mirror having cost \$7.50. This was supported on a standard of 1½-in. gas pipe set in the ground. This mirror is occasionally cleaned by the lamp-lighter when cleaning the lamps. The mirror used in this case was a plain, flat one, but Mr. Nichols suggests that they would be of greater value if slightly

convex, in order that a larger area could be observed than is possible with a flat mirror. At Malmesbury, according to Borough Surveyor Chas. Bowman, a mirror has been erected on two pillars spanning a pathway at a dangerous turn, as shown in the illustration. This requires scarcely any cleaning, being wiped off about once in three months, but 'is not of much use on a foggy or frosty morning until the sun or rain has been on it for a few minutes.' In each case the engineer states that there have been no accidents at the corners in question since the mirrors were established."



LOCATION OF STREET-MIRROR /

SOME PHASES OF THE

WITH INTRODUCTORY REMAINING THE ILLUMINATING ENGINEERS

45065

BY PRESTON S. MILLAD

Whether it is carelessness which induces Mrs. Lux to read with her page dimly illuminated by light from the reiling and wall, while facing the light, is open to question. Perhaps she may feel that her appearance is more attractive with the light full upon her face.

Wall brackets may be employed with good effect if equipped discreetly. For utilitarian purposes they are of value chiefly in providing local illumination. It



Courtesy Photographic Department
The New York Edison Company.

FIG. 8.—SHOWING ILLUMINATION FROM WALL
BRACKETS ALONE.

is very difficult to light a room solely from wall brackets (Fig. 8).

The light cannot be distributed satisfactorily in the room without placing light sources immediately within the range of vision. Wall brackets find best application when employed in rooms in which the main illumination is provided otherwise and the brackets are equipped with decorative shades, the installation serving purposes of ornament rather than utility.

Daylight, being that under which the human eye has been evolved, may be ex-

pected to as the pairies for which the ferences l amateral conditions for which the eye is adapted and the artificial conditions with which we have surrounded it (such as the change from distant to near vision and the change from use of the eve during daylight hours only, to use of the eye for almost as long a period during the hours of the night), there still remain certain differences between artificial and daylight, the study of which forms a most interesting field for the illuminating en-Daylight out-of-doors is the standard against which we must compare buch artificial light and daylight indoors, for the daylight which is available in our interiors differs materially from that catof-doors in respect to quality, intensity and direction. The intensities may be fybra old to 0.001 of those which prevail wasof-doors in bright sunlight. The au may differ not only in respects w. are not perceptible to the eye, but o differs in color due to the influence of absorption of colored walls, etc., which materially alter the color of the natural light. The direction is usually quite different. In regard to the desirability of such direction of light as that which is prevalent in interiors illuminated by daylight, there is considerable discussion at the present time, pro and con. My own view is that usually the direction is undesirable. Coming through a window or windows on one side, or at the most, two sides of a room, usually at an angle somewhere between the horizontal and 45 degrees above the horizontal, the light is very unequally distributed. The floor and opposite wall receive the greater part of it, while the wall on the side of the room in which the windows are cut, is illuminated only by such light as may be reflected from the



Courtesy Photographic Department
The New York Edison Company.

FIG. Q.—DAYLIGHT ILLUMINATION.

floor and the opposite wall. Persons sitting in the room are likely to have the window and the bright sky within the field of vision, or else they are likely to sit in such a position that their faces are not well lighted. The light is incident upon horizontal surfaces at a very sharp angle, and there is only one good position for writing, or two good positions for reading, if glare from the window or the paper is to be avoided, and as well shadow from the body or hand. Practically the ong way of bettering these conditions which has been developed so far, is to a window shade to protect the against direct light from the sky, and is done of course at the expense of illumination of the room. The usual uirection of the light is in my opinion objectionable both from the standpoint of utility and good appearance of the room. The proper utilization of daylight for interior illumination is a subject of which the study has not yet been undertaken

seriously.

There is one quality, however, in daylight, whether out-of-doors or indoors,
which has until recently been lacking in
our artificial lighting—and that is, ample
diffusion. Interiors are illuminated as a
rule from a portion of the sky, the light
source being as large as the unobstructed
portion of the window. Out-of-doors,
even in brilliant sunlight, the sky light is
a considerable factor in the total illumination. Of recent years more attention has
been given to this quality of diffusion,

which previously had been lacking in our artificial lighting. Early consideration of lighting principles brought realization of the harm which exposed light sources work, and led to attempts to conceal the light source. There was evolved, among other systems, that of cove lighting. In the process of concealing the lamps and permitting the light to fall upon a white surface, from which a part of it was reflected into the room, the light was thoraughly diffused. This system of lighting is more notable in regard to the success with which it concealed the light sources and diffused the light, than in other respects. Historically, it is notable for the evidence which it affords of growing appreciation of some of the principles of good lighting which are now considered to be thoroughly established. The trouble with cove lighting as usually applied, is that control of the direction of the light is lost, and that the flux which is permitted to escape from the cove is diffused promiscuously throughout the room, producing a flat and characterless effect. Only a small portion of the flux is directed where it is most wanted, while perhaps an equal portion is permitted to fall upon surfaces where it is not desired in such quantities. The system has not been largely applied, in bridge found possible to realize its advantages by other methods which are free from some of its disadvantages.

More recently another system of indirect lighting has been developed, in which central fixtures are employed to conceal the lamp from view and direct much of its light to the ceiling, from which surface it is diffused downward. More engineering study has been devoted to this system of lighting, and in consequence its possibilities have been more largely realized, than were the possibilities of cove lighting. This system of indirect lighting has been widely exploited, and has given considerable satisfaction in a wide variety of installations.

Direct lighting, in which the great bulk of the light utilized comes directly from the light source, had been abused with detrimental results. Particularly was it lacking in diffusion. Indirect lighting is the other extreme, possessing in a high degree the element of diffusion which is

so often lacking in direct lighting systems. The rapid growth of indirect lighting is the manifestation of a protest against abuse of direct lighting. Its effect has been to introduce into direct lighting practise a considerable general improvement, which has corrected, or decreased some of the evils of direct lighting. And too much credit cannot be given to the explaints of indirect lighting devices for the neficial influence which they have exercise pon our lighting practise in general.

In the lighting fixtures here shown (Fig. 10), the lamp in the metal bowl is

Following closely upon the development of the indirect lighting system come systems classed inaccurately as semi-indirect lighting units, in which part of the light is reflected from the spitling, as in the indirect system, while part of it comes directly from the translucent bowl surrounding the light source. It is obvious, of course, that with any translucent lighting auxiliary employed in a direct lighting system some of the light which reaches the ceiling and walls is reflected downward, and that the system is thus a semi-indirect system. Those units which are classed as semi-indirect units at the present time are, how-



Courtesy Photographic Department The New York Edison Company,

backed by an efficient mirrored reflector, which directs its light toward the ceiling. The rooms have been equipped with three ceilings, one in white, and has about as high a reflecting coefficient as is likely to be found in practise. Another is cream colored and reflects a smaller proportion of the light. A third is a dark cream, approaching a tan, and reflects still less of the light. This latter is about as dark as one might expect to find employed in an indirect lighting system, where any attention is paid to efficiency. Indirect lighting is so largely dependent upon the reflecting qualities of the ceiling that the statistics of the illumination intensities in these rooms are of interest. The horizontal illumination intensity on the table plane averages for the three ceilings:

White	ceiting	g						100 p	er	cent.
		ceiling								
Dark	cream	ceiling.	 				 	58 p	er	cent.

to the inferior reflecting qualine darker ceiling. ever, units designed especiall the liew directing a consideral prevail of the light toward the ce. The second estable combination of directing the second estable combination of directing the second estable combination of directing the second establishment of the second establishmen

Views of illuminating engineers vary in this matter. All kinds of relations between these two components are to be found represented by outfits now available in the open market. These range from equipments in which the transmitted light is so small a proportion of the total as to make it apparent that the purpose to be served by the direct component is chiefly one of decoration, to those in which the direct component is so large as to make evident an intention to increase the efficiency considerably by restricting the

It was discovered too late for correction that the light cream ceiling has diffusing qualities so unlike the dark cream ceiling that in spite of reasonably typical intensities on the table plane, the appearance as viewed from without the rooms is not consistent with the intensity figures shown; thus, the ceiling in room 2, when viewed from the table, is much lighter than the cei' z in room 3, though it does not so appear in the figures.

amount of light which is subjected to the

inherent ceiling loss.

In the photograph (Fig. 11), three semi-direct lighting fixtures are shown. In room No. 1 a direct lighting reflector is inverted. In room No. 3 a boyd, not intended for this purpose is employed. The design of its surfaces is not well adapted to this purpose, and it is therefore not so efficient as it might othe wise be made. In room No. 2 a hemisphere is utilized, illustrating semi-indirect lighting in the simplest of its characteristic forms.

It is a matter for gratification that illuminating engineers to-day have such an

glare and shadow is a consideration of paramount importance, an indirect or a semi-indirect lighting system may often be preferable, in spite of the necessity for somewhat greater expenditure in energy. Where these considerations are not so important, or where economy of operation is the prime consideration, a direct lighting system may prove preferable. In any case, the adroitness of the illuminating energy exhibit itself in securing the balance between economy, on the balance between economy, on the other. As to the appearance of the installations, there may be all kinds of di-



Courtesy Photographic Department The Muny York Edison Company.

FIG. JI.—SEMI-IND2-FFCT LIGHTING.

choice as that afforded by the available equipments for and semi-indirect lighting _ach has its merits, each its deaga n some installations one type is in other installations some other type may produce most desirable re-The good qualities which characterize each are coming to be incorporated, as far as practicable, in the others, and it may be noted that the more vigorously each system is exploited the more beneficial upon lighting practise in general will the result be. With a direct lighting system it is a simple matter to direct a relatively large percentage of the light downward upon, say, the table plane; but it is a difficult matter to so dispose the lamps and to so equip them that the installation will be free from troubles due to glare and shadow. With an indirect lighting system it is relatively a simple matter to avoid deleterious effects due to glare and shadow, but it is very difficult to direct a ratisfactorily large percentage of the light upon the table plane. Where absence of

verse views, and we must remember that there is no disputing taste. Obviously it is difficult to discuss those phases of the question when dealing with the subject in a general way.

The three modern systems of lighting are represented in this illustration (Fig. 12). In room No. 1 the direct lighting unit transmits sufficient light to make the walls pleasantly but not objectionally bright, while directing much of the light to the table plane. In room No. 2 the semi-direct unit illuminates the card by light direct from the bowl and by light from the ceiling and walls in something like the proportion of 3 to 1. The relative direct and indirect components upon the table plane are of the order of 11/2 to I. In room No. 3 all of the light is diffused from the ceiling. The ceiling is the brightest surface within view, the lamp The illuminabeen entirely concealed. tion is very soft and uniform.

Comparing the two end rooms, be noted that in room No. I think stripes in the wall-paper may



Courtesy Photographic Department The New York Edison Company. INDIRECT. SLMI-INDIRECT.

FIG. 12. THE COMMON METHODS OF ILLUMINATION OF THE PROPERTY OF

standing out clear and sharp. The character of the pattern is evident. In room No. 3 these stripes are seen somewhat less distir tly. This is due to the lower intensity of the on the wall. Still more imporwever, as a factor, is the downtion of the light from the ceiling. I from the table these stripes stand out distinctly as the a tie and direction are then such as to be within the zone of strong specular reflection from the wall-paper. Viewed as in the photograph, these stripes can hardly be discerned except on the upper part of the walls near the border. The paper loses its character. This is an excellent illustration of the importance of securing proper direction from the major part of the light, although it should not be taken as an indication that the direction is wrong in this installation, because it must be remembered that the effect would be minimized if the wallpaper were viewed from within the room instead of from without.

With the conditions as established (and it is not claimed that they are more than suggestive of typical conditions) the card illuminations are as follows:

Room	No.	1.									. :	220	per	cent.
Room	No.	2.										100	per	cent.
Room	No.	3.										42	per	cent.

It must be remembered, however, that the direct lighting unit in this case is favored, because the card is immediately beneath it at the point of highest intensity. For corposes of reading, as an example, it is difficult to judge from these figures as to the relative useful light. In the first the context, questions of diffusion may result in the point one system than in another.

This is ortent the questions which is being very generally investigated at the present time and in such a review as this its difcussion has no place. Dealing solely with the question of direction, it may be justed that the line would be likely center of the con, and the many three directions of the dispersion in rating whic which intensity of the cird immedia beneath the unit would appear to give it. The relative higher intensities in the corners of the room with the indirect and to a lesser liber of the serni-indirect, harring telly pet : in this records each type of lighting. no zontal intensities are pela;

Direct lighting1.61 ft.
Semi-indirect lighting
Indirect lighting

It is generally believed that with conditions suitable for each system of lighting the direct lighting system will deliver about twice as much light upon the table plane as does the indirect lighting system, while each will illuminate the walls moderately.

The decorative feature has kept pace with developments in the other branches of the art. Lighting auxiliaries are consistently being improved in appearance, as well as in other features of effectiveness. Efficiency of reflection, the necessary degree of diffusion and the proper direction of light are being achieved more and more completely as experience becomes greater. In good taste and other qualities that make

being feets constant advances are

For line of a tor as ware, including mism averbein modified so as to and the more pleasing in appearance. The place of the place of new inessential place of attendives in the way of glasswale equipment suitable for use with any given type of fixture in any ordinary installation.

These demonstrations must be ta with some query leations. They do pretend, in all cases to be typical of particular class or instillation. Time not permitted a thorough discussion the characters in qualities of any one Appearances have been different rome these which would have presented the rooms been above from within.

The boy thing which seems to me to



Courtesy Photographie Dadt Lient The New York Edison Company.

FIG. 13.—SU ASTING DECORAST OR ORNAMINAL LIGHTING UNITS.

with that, unless the installation with fair satsfaction. Unless installations are considered which are so unusual as to demand the design of special lighting equipments, those now obtainable must be considered to afford a very satisfactory range of selection.

In the photograph (Fig. [3]), may be

have an immediate bearing from the central station standpoint, and which I hope is recognized by all of you, is that if artificial lighting is to be made thoroughly good and satisfactory, it is necessary to thoroughly diffuse and otherwise modify the light which is produced by the lamps. This cannot be accomplished without considerable loss of light, and therefore entails greater consumption of electrical energy or gas. Thus immediate commercial advantage goes hand in hand with good business policy and with altruism, when the central station spreads the gospel of good lighting among its customers.

(Note.—The foregoing is, in substance, the report of a joint meeting of the New York Companies' Section of the National Electric Light Association and the New York Section of the Illuminating Engineering Society, held in the New York Edison Auditorium, November 18, 1912.)



THE ELECTRIC OPAQUE PROJECTS OF LARGE OBJECTS

The accompanying illustration shows a most powerful electric projection apparatus with two high power ar lamps. It is claimed that a new realm of usefulness has been opened up for optical projection by this unique electric balopticon designed for the projection of opaque of ctransillustrative material direct on an illustrative material direct on an illustrative material direct on the larger scale characteristical modification and presents new possibilities for attractive form of projection.

The original apparatus was device an experiment in an endeavor to proma instrument of sufficient scope to projon the screen an entire section of a cregister and was most successful. Trunstruments are now used in education salesmen to a more intimate knowledge at their product and of the effect becamed to market it. A series on the screen with the program in accordance of the screen with the screen wit

It is pointed out that in addition to these commercial uses this new electric projection can be used to advantage in projecting full-page illustrations from large magazines, or photographs and engravings of any size up to venty inches square. In additional to the cation of the service, as it is especially suitable for projecting large embryos and anatomical specimens. All subjects and omical specimens. All subjects and omical specimens. All subjects and omical specimens are all subjects and only shown in their natural form in greatly enlarged images, conveying a certain sense of the true relation of the parts projected.

handle such a wide scope of strument was constructed ng for objects measuring quare. To cover this wide ient illumination the first problem to be

fully accomplished by

mounting two large 90 degree to the in their light-tight louses at a surangle to the object table to be posed area with the control of the interest of condenses at a surangle to effect their the use of condenses at a surangle to effect their the use of condenses at a surangle to effect their their the use of condenses at a surangle to effect their thei

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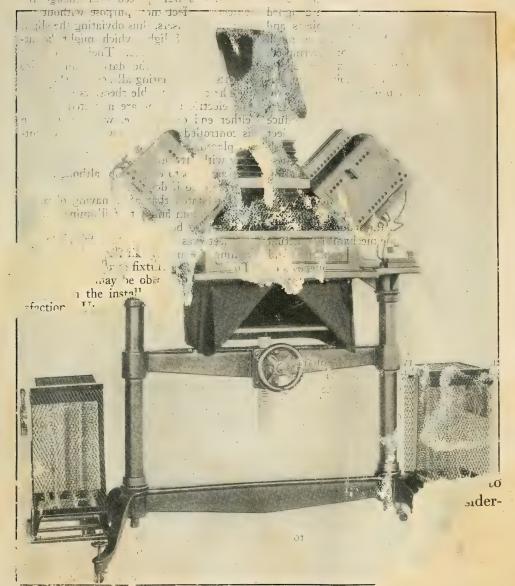
is stated ther effect to ned

It will be seen that a mirror is required above the projection lens to direct the image toward the screen, since the objects are held in a horizontal position because of their size and weight. This also serves an important purpose as a reversing mirror, so that objects, illustrations and printed matter are shown on the screen in their true position. The mirror employed is of a very high grade, measuring 175 9½ inches and silvered on the first surface to render the amount of light absorption practically negligible. It is enclosed in a wooden case lined with a chemical preparation to prevent oxidation and is eas:1" adjustable to suit different conditions.

It may be seen that this unique instrument is naturally one of unusually large ection lanter. The aspread of 4 x 24 inches, being provided with both castors and to too of the mirror is approximately 80 inches. The dark chamber is 23 inches square laterally, with a distance in the from its extreme top to the control of smoked glass, covery the process of smoked glass.

work to advantage in placing the object in cosition with at disturbing the carrier.

Another device for the projection of vertical objects is being designed. It is said the projection of large opaque objects held in a vertical position can be had. With this instrument no mirror will be necessary, and it will be possible to show printed matter or other objects in their true position by projecting from behind



For the Rapid Identification Waiting Automobiles

By Bernhard Hoffman

The problem of quickly and efficiently summoning waiting automobiles at night for their respective passengers after the theater, opera or other gatherings, which has been a difficult one, is becoming rapid-

ly more acute.

Many plans have been tried and it will be recalled that on the opening of the New Theater in New York a year or so ago, a plan was tried whereby the numbers of the cars which were in line and approaching the door were consecutively displayed in lobby. It was expected that that users would note the approach of the respective cars through the medium of these numbers and be ready to promptly take their places when the car was actually at the door. But in general, whether the owner desires to have his car approach the waiting place in line in answer to a called or flashed signal, or whether he arranges to meet his car when he is ready at or near some prearranged location, the problem of quickly identifying a particular car among a large number at night is responsible for much delay, confusion and inconvenience.

The device illustrated shows how this difficulty has been overcome in one instance. On the roof of the closed body is mounted a small electric light controlled by a switch alongside the driver's seat. The lantern, which is a converted globular rear light, has white lenses on the sides and front. The lamp is green or may be any other color except red.

It may be urged that any very general adoption of any such device would defeat the object in view, but should that ever occur, it will have been one step toward some plan which must be developed in order to bring about the efficient association of waiting cars and would-be passengers at night.





A NEW DEVELOPMENT IN PRINTING ILLUSTRATED BOOKS AND MAGAZINES

by Julius S. Weyl



HE average reader of magazines and illustrated books observes the glossy coated paper upon which most of the pictures are printed with merely a casual annoyance. He notes that almost all of the halftone (or photographic) illustrations are printed upon such paper, and occasionally resents its glare and lustre, particularly if there is text matter upon these pictorial pages, which, by consuming more

time and effort in its reading than are required for the examination of an il'ustration, results in eyestrain and a feeling of discomfort. Few readers know why such paper is used.

Before 1880 the most elaborate illustration in magazines or ordinary books was the woodcut. This was a piece of boxwood, upon the end grain of which the picture was either photographed or drawn and then hand engraved with various cutting tools. The wood engraver had considerable license, as he had to translate into line and spots of light and shade the various features of the drawing or photograph, and no two woodcuts of the same picture were ever identical, even though made by the same engraver. The woodcut printed because the lines forming the picture were left upon the surface and received ink from the inking roller on the printing press. The parts showing in white were those lines and spaces which were cut below the surface and which were too low to receive the ink, and could, of course, make no mark upon the paper. The printing lines and dots upon a woodcut were relatively coarse, seldom being less than one-fiftieth of an inch apart, and the paper required to print them did not need to be particularly smooth, although a considerable degree of smoothness was occasionally given to paper.



Between 1880 and 1890 the halftone plate first came into use and quickly superseded the woodcut. Its cheapness was, of course, its main attraction; but in addition to this quality the rendering of a photographic subject or even of a picture was practically absolute because the work was mechanical and left no room for the insertion of the individuality of

the wood engraver. Directly the halftone plate came into general use it was seen that a radical change in the character of the paper most commonly employed for illustrated books and magazines was essential.

This can be better understood by a short description of the nature of printing paper and its manufacture. Paper consists of three, and sometimes four, principal elements: first, the body or fibre. This is usually a wood fibre which has been cut or ground to an almost impalpable fineness and which furnishes the body or element of strength. These fibres are treated with caustic potash to remove the resinous or gummy coating and are then bleached with some compound of which chlorine is the active element; second, the filler. This is usually a medium quality of white clay which is mixed with the fibre in an aqueous solution and which serves the purpose of filling the interstices between the fibres, and gives the paper a smoothness otherwise unattainable; third, the sizing. This is an adhesive substance mixed with the clay and wood fibre for the purpose of holding the paper together and increasing the smoothness and finish, as well as reducing the absorptive quality of the fibres and clay. The smoothness and lustre are much dependent upon the quantity of sizing used and the amount of calendering or rolling between polished steel and paper rolls which the paper finally receives. All of



this refers to "uncoated papers," known as machine finished or sized and super calendered paper. The former is paper only moderately calendered and the latter additionally calendered or "super" calendered.

These were the only papers generally used for publications until the invention and development of the halftone made a smoother paper necessary. Neither of these papers were particularly smooth nor shiny, as the type and woodcuts then in use were comparatively coarse and printed very well upon them. When the halftone came into use a smoother paper was required, as its printing surface was made up of dots of varying sizes, averaging almost 25,000 to the square inch. The picture being produced by the varying strength of these dots, the maximum size of which is 1–22500 of a square inch, and the minimum is almost invisible, it can readily be seen that a very smooth surface is required to lay down in printing ink the correct value of each dot, without which accuracy the picture becomes blurred and indistinct. The halftone is practically a translation of the light and shade of a picture into light and dark (small or large) printing dots which represent the original light and shade of the picture.

The process of making halftones is almost entirely automatic, consisting of photographing the original object through a lined screen of glass upon a sheet of sensitized copper. The screen is covered with two sets of parallel lines running diagonally and at right angles to each other. In most cases these lines are 1–150 of an inch apart, and therefore they cut the surface into 22,500 dots to each square inch of surface. The image or picture to be reproduced is photographed through this screen upon the sensitized copper plate, but is cut up into 22,500 dots to each square inch of picture, each of these dots being entirely separated from the neighboring or adjoining dots. Each dot is small or large according to the lightness or darkness of the part of the picture which it represents.

The sensitized copper plate upon which the picture has been photographed in the form of a myriad of dots is now ready for etching. Where a dot represents a light (or white) spot it has received a large amount of light, while a nearby dark spot will have received very little light. The effect of the light is to decompose the coating, and each dot is fixed or hardened in proportion to the amount of light which it has received.

This coating, though sensitive photographically, is a "resist" or insulation against the acid with which the copper plate is afterward etched. The coating is now developed, and that portion of each dot which has not been hardened by the actinic light is washed away. The remaining coating is "fixed," and after drying and baking is ready for etching. The copper plate is now smooth to the touch, although the image of

the picture is plainly visible, as it is already translated into dots, each of which corresponds in size to the degree of light and shade upon the corresponding point of the picture.

The plate is now etched by immersing it in a bath of perchloride of iron. The dots of coating upon the surface protect the copper beneath them and are reproduced in the form of copper dots, the space between being eaten away by the acid, making depressions of about 1–500 of an inch in depth and 1–225 in width. We now have our picture translated into a series of relief dots as described, which can be printed on paper.

The inventors of the halftone were confronted with the problems of obtaining a suitable paper and ink for printing a piece of copper (or halftone) which was almost smooth to the touch. The ordinary machine or super calendered papers were frequently not as smooth as the halftone, from which they were to print. This was partly caused by the fibres of the paper being too coarse and the sizing being unsuitable to the new purpose. The paper was also too absorbent and required the use of too much ink. Since the depressions in the halftone (the non-printing parts) were very small (1–500 of an inch deep and 1–225 of an inch wide approxi-



mately) the quantity of ink required to satisfy the absorbent quality of the paper was sufficient to flood the non-printing parts and to make them print, which ruined the effect of the picture.

It was therefore necessary to obtain a smoother and less absorbent paper. For many years fancy, colored and white papers had been made for the covering of fancy boxes such as were used to contain candy, hand-kerchiefs, fancy articles. This was made by coating machine finish paper with a thin solution of animal glue in which Chinese white clay or certain very fine English clays were mixed. This was applied hot with revolving brushes. When dried it was calendered between hot steel rolls, which gave it lustre which was sometimes increased by the addition of paraffine to the glue and clay.

It was thus possible to obtain an ideal smoothness, as there was no fibre to be compressed, only the glue and clay, which were easily forced into a smooth surface. This coating, after much experimentation, was adapted to the needs of the halftone printer, and his inks were also ground finer and otherwise made more suitable, and within a few years after the invention of the halftone very good printing results were being obtained.

The zeal of the new convert is proverbial, and having been inducted into the use of a shiny paper the printer sought the most brilliant ink and the most lustrous paper, under the mistaken impression that shine and brilliancy were the great and final desiderata in halftone printing. Illustrations were forced by retouching or painting the highlights whiter and the shadows darker, under the mistaken impression that the brilliant result justified the outrage upon good taste and fidelity to the nature of the object reproduced. There was little in nature as lustrous as the results which were then so highly prized by the publisher, advertiser and printer, and a revulsion against this use of a too shiny paper and the general "varnished" appearance of halftone printing was caused by a number of objections; first, the objectionable glare of the paper which when used in connection with type-printing was irksome to the eye; second, the expense, coated paper of a given thickness being heavier than uncoated and costing more per pound; third, its mechanical weakness and lack of permanence. Catalogs and other advertising material printed upon it lacked durability, as the strength was only in the paper and not in the coating.

There is no line of activity in which the direction of taste is continuous. The pendulum swings from side to side; and some years ago the highest point of the development of glossy papers was reached in the manufacture of papers that were double coated on both sides, producing a surface of such an extraordinarily high polish that when held in certain lights it

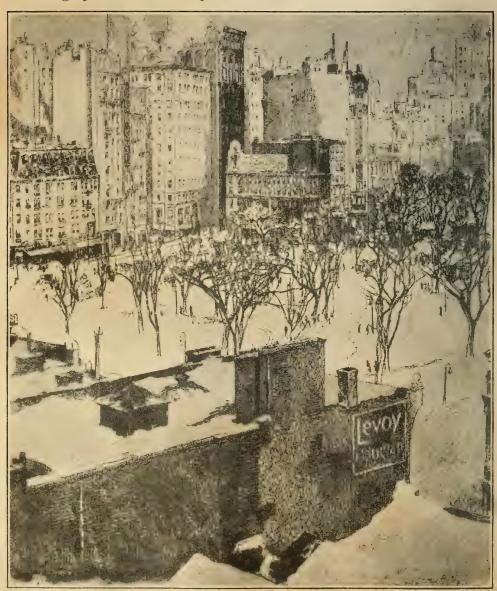


was impossible to determine what was printed on it. The use of this paper was very short-lived, and the tendency is now in the other direction.

As the halftone plate improved in quality the methods of printing it also improved, until now we believe that the improved methods of making halftone plates and printing from them will permit the use of real book paper, with its softness and strength and permanence. For ordinary

illustrations, such as are used in books and magazines, where the finest mechanical detail is not a desideratum, it is quite possible to produce beautiful printing from halftone plates on book paper. To be sure, a coarser halftone screen must be used, and the adjustment of the paper to the ink must be exceedingly nice, as well as the mechanical skill employed in the presswork.

These pages are offered as a specimen of what may be accomplished in a thoroughly commercial way in this direction.



From an etching by Earl Horter

EDITORIAL

THE EDITOR DOES NOT NECESSARILY IDENTIFY HIMSELF WITH THE OPINIONS EXPRESSED IN CONTRIBUTED ARTICLES PUBLISHED OF GOOD LIGHTING

PRINT, INK AND PAPER

At tirst thought, one might feel that the subject of printing was without the field of the lighting student.

Wrong!

Light is required to "see."

And as we "see" only by reflected light, we are very much concerned, or should be, in the character and treatment of reflecting and absorbing surfaces.

The Editor has been a student of printing, and its relation to light and vision, for some time, and several years ago publicly treated with the theory of *light-tinted* symbols on *dark backgrounds* in printing.

Such development is largely for the future.

A few months since, upon assuming the editorship of GOOD LIGHTING, the writer put into effect the use of a "natural" colored paper, as opposed to the prevailing "hard" blue-white paper, that was remarkably free from glaze (productive of glare); also a non-glossy ink, all of which has made the reading of GOOD LIGHTING a pleasure instead of an effort, heretofore the case, with its attending strain and injurious effects.

In the interest of development a somewhat different kind of paper is employed in this (January) issue.

The Editor has been engaged in experimentation relative to the form, size and placement of type, the result of which study will shortly find expression.

In this issue of GOOD LIGHTING is show. What is probably the greatest practical advancement in the art and science of lighting in a number of years.

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In the special eights are inserted with the special eights described which the special eights described which the special exceedingly clear and was another than the special exceedingly clear and was another than the special exceeding the spec

When it is understicate for the cost of this plost sweet and that the cost of the paper is considered where illustrations are to development will be see apper the

The possibilities as regards of are countless, and the benefits to be nomic and æsthetic standpoints w

This method of printing should awarrat with non-gloss, which turther tengent and injurious glare.

Further development in the sea press in in Good Lighting

CONSTRUCTION Adv od her it

The Editor pleads guilty of here is a general and prime movers for to the state of season and prime movers for the state of the s 10t always ha ... for the æsthetic in lighting The propagandish of the Thorogonal to sussi side po for harmonious conditions (10 de la libra de la guerra as) la the Bath showledge which well Los To the avera Will person is f of thought still attends equipment with referre architecture and Jecording ?! The Faitor, with a in the perating, r a ation of desires, a rangements for the escribbo. first of a second relationer with the ruipale ars in this is ud dealing stiving opn. LIGHTEN on Ansiderable detail, in future in: 514 37 . of design, as applied to lighting in not .

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ore.

The announcement appearing on opposite page made its first appearance in the last (December) issue.

That such development is needed and appreciated has been evidenced by the character and quantity of responses received.

Let this special service serve you.







